NE, 1947 TECHNOLOGY DEPARTMENT TWO SHILLINGS

Plastics

ALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

BUS LIBRARY
JUL 5 1947
DETROIT

WERE SOME OF THE PROBLEMS
solved by BAKELITE PLASTICS
Problems of design . . .
problems of production
. . . problems of strength
and weight, speed and
pressure, movement and wear
. . . problems of resistance to
heat, cold, water, acids, chemicals
. . . solved by using the right type
of Bakelite material in the right way.

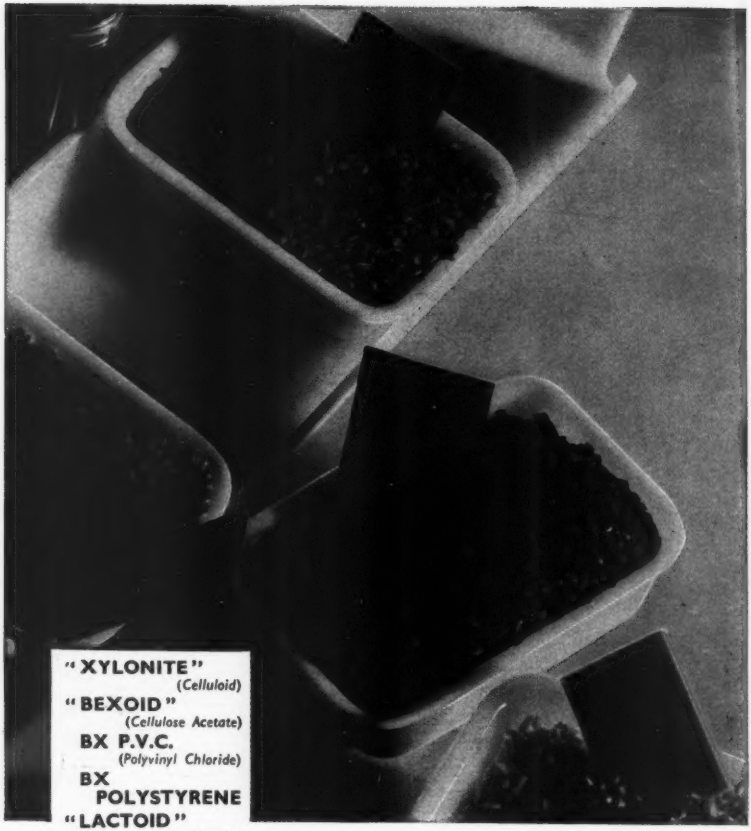
TREFOIL

BAKELITE PLASTICS

REGD. TRADE MARKS

Essential Materials for Essential Work

T103



"XYLONITE" *(Celluloid)*
"BEXOID" *(Cellulose Acetate)*
BX P.V.C. *(Polyvinyl Chloride)*
BX POLYSTYRENE
"LACTOID" *(Casein)*
BX ETHYL CELLULOSE
"ISOFLEX" *(Lightweight Thermal Insulation)*

Industrial Hors d'oeuvres

Hors d'oeuvres—first step to a successful meal. BX Thermo Plastic Materials—first step to the successful manufacture of a multitude of modern products. Here you see Bexoid Moulding Powder on which you can depend for absolute fidelity of reproduction. Supplies of all materials are limited, but our Research and Technical Service Department are at your service to advise in developing your future plans.

BX

LEADERS IN THERMO-PLASTICS

HEAD SALES OFFICE
BX PLASTICS LTD • HIGHAM STATION AVENUE • LONDON • E.4
Telephone LARkswood 4491

AREA SALES OFFICES
King Street Buildings, 1 Ridgefield Manchester 2
Telephone : Manchester Blackfriars 0258.
42 Wellington Street, Sheffield.
Telephone : Sheffield 25517.
48 Moor Street, Birmingham 4.
Telephone : Midland 0132.

WORKS : **LONDON, MANNINGTREE, DUNDEE**

TAYLOR 1249

YOU CAN'T STOP A MAN WITH A GOOD IDEA

"Sorry, folk, but I must phone Lorival at once to see if rubber would do the job."

RUBBER OR PLASTICS?

★ *While each material possesses its own characteristics, in many applications one is as suitable as the other, and in these times of scarcity it is as well to have this in mind. Firms in need of components, complete articles or packaging should seek our advice, which is based upon wide experience and specialized knowledge. We produce articles in rubber and ebonite as well as plastics, and our service includes design and manufacture.*

LORIVAL PLASTICS

UNITED EBONITE & LORIVAL LIMITED

LITTLE LEVER, NEAR BOLTON, LANCS

"His advice on fuel efficiency brightened our whole production prospects"

"SOMETHING had to be done—we were receiving fuel of unfamiliar grades and in unsatisfactory quantities—so I suggested obtaining independent specialist advice from the Fuel Efficiency Branch of the Ministry of Fuel and Power. I knew of several factories where a visit by the Ministry's fuel efficiency engineers had taken a lot of the sting out of fuel problems.

"We decided to give it a trial and contacted the Regional Fuel Office. A fuel efficiency engineer visited us and made a thorough study of our plant. His report set out broad recommendations on boiler house operation, the use of waste-heat, insulation and certain other items. Our own engineers agreed with the recommendations, so we had plans drawn up and went right ahead on them. The result has been an immediate brightening of our whole production picture."

36,000 firms have taken advantage of this free service and all have benefited—many have achieved major fuel savings and production improvements. Ideas developed in one industry have been applied in others through the uniquely varied experience of the visiting engineers. Brewers, for instance, have learned from launderers and vice versa. The fuel efficiency engineer's sole concern is the more productive generation and use of heat and power. "Output has doubled: fuel consumption is actually 10% less" is by no means an unusual report on what has been accomplished.

Why not get into touch with your Regional Fuel Office and arrange to have your plant surveyed?

HERE ARE OTHER SERVICES AT YOUR DISPOSAL

1. *Training of boiler-house personnel at your factory.*
2. *Instructional classes for boiler-house personnel.*
3. *Evening classes, lectures and films for executives, boiler attendants and maintenance staff.*
4. *Advice and help in setting up joint fuel efficiency committees for works.*
5. *Publications (e.g. "Fuel Efficiency News," special bulletins, leaflets, posters, etc.).*
6. *Fuel efficiency films, slides and film strips.*

YOUR REGIONAL FUEL OFFICE

REGION	ADDRESS	TELEPHONE
Northern	Government Buildings, Ponteland Road, Newcastle-on-Tyne, 5.	Newcastle 28131
North-Eastern	71, Albion Street, Leeds, 1.	Leeds 23616
North-Midland	Castle Gate House, Castle Gate, Nottingham.	Nottingham 46216
Eastern	Shaftesbury Road, Brooklands Avenue, Cambridge.	Cambridge 56268
London	Mill House, 87/89, Shaftesbury Avenue, W.1.	Gerrard 9700
South-Eastern	Oakfield Court, Grove Hill Road, Tunbridge Wells.	Chatham 3238
Southern	Whiteknights, Earley, Reading.	Reading 61491
Wales	27, Newport Road, Cardiff.	Cardiff 9234
South-Western	12/14, Apsley Road, Clifton, Bristol, 8.	Bristol 38223
Midland	Temporary Office Buildings, Hagley Road West, Birmingham, 17.	Bearwood 3071
North-Western	Burton Road, West Didsbury, Manchester, 20.	Didsbury 5180-4
Scotland	145, St. Vincent Street, Glasgow, C.2.	Glasgow City 7636

ISSUED BY THE MINISTRY OF FUEL AND POWER

A New FERODO

South London Depot

Opened

MARCH 3rd

at

FERODO HOUSE

35 CLAPHAM HIGH ST. S.W.4

Telephone: Macaulay 3381 Telegrams: Frodofix Phone

PLASTICS *AND THE ASHDOWNS ORGANIZATION—*

KEEPING PACE WITH PRODUCTION SCHEDULES

In the Assembly Shop a moving belt sets the pace for accurate output. Here, experienced hands and modern tools drill and tap the mouldings. Assemblies are then sorted and inspected before despatch to the client. A large staff of technicians, designers and workers in the two acre Ashdowns plant are well equipped to carry through a plastics job from original project to finished product. Strict tests applied at each stage of manufacture ensure the maintenance of precise standards. Our twenty years experience is at your service. Why not write to us about your project?

If you've a problem that plastics may solve —

ask Ashdowns

ASHDOWNS LTD., ECCLESTON WORKS, ST. HELENS, LANCS. *Telephone:* ST. HELENS 3206

Ashdowns is a subsidiary of Pilkington Brothers Limited

FROM FINE FINISHES

The well-known CELLON range of products has been built up largely by the rapidity with which the CELLON technicians appreciate the importance of new innovations and new industries.

The rapid increase in the use of Plastics presents intricate but surmountable problems and, in fact, CELLON Synthetic Finishes and Thermo-Plastic Adhesives have already been devised and are in use for numerous special purposes.

CONSULT CELLON on all problems of finishing or jointing materials, and let them give you the benefit of their experience in this and other fields. The address is Richmond Road, Kingston-on-Thames, Surrey. Telephone: Kingston 1234 (5 lines).

TO FINE ADHESIVES

CELLON

A Cellon product

The final word in finishes...

CELLON
CERRIC CERRUX

CVS-537

for second-hand machinery FOR THE PLASTICS INDUSTRY

also Electric Motors, Oil Engines

Pumps, Compressors, Fans, Blowers

Boilers, Tanks & Works Equipment

ONE OF THE 600 GROUP OF COMPANIES

Send your enquiries to the largest Stockholders

GEORGE COHEN

SONS & COMPANY LIMITED

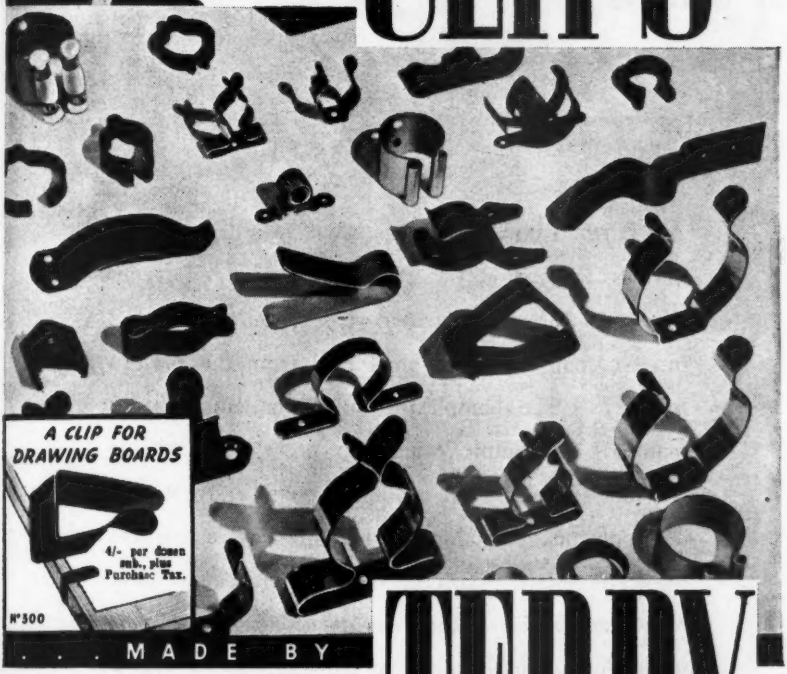
WOOD LANE, LONDON, W.12 · Telephone: Shepherds Bush 2070 . Telegrams: Omniplant, Chisk, London and STANNINGLEY, NEAR LEEDS · Telephone: Pudsey 2241 · Telegrams: Coborn, Leeds

ALSO AT BIRMINGHAM, NEWCASTLE-ON-TYNE, SHEFFIELD, MANCHESTER, GLASGOW, SWANSEA, SOUTHAMPTON, BELFAST, BATH, ETC · ESTABLISHED 1834

471/P117

"I never knew there were so many kinds of...

CLIPS"



TERRY

springs

People are amazed when they learn of the variety of CLIPS we make—steel clips, bronze clips, stainless clips, big clips, small clips . . . clips in every conceivable shape and pattern . . . clips for every possible use. We can make to print or specification or our Research Department can design a clip for that particular job of yours.
Over 92 years of clip-making is at your disposal.

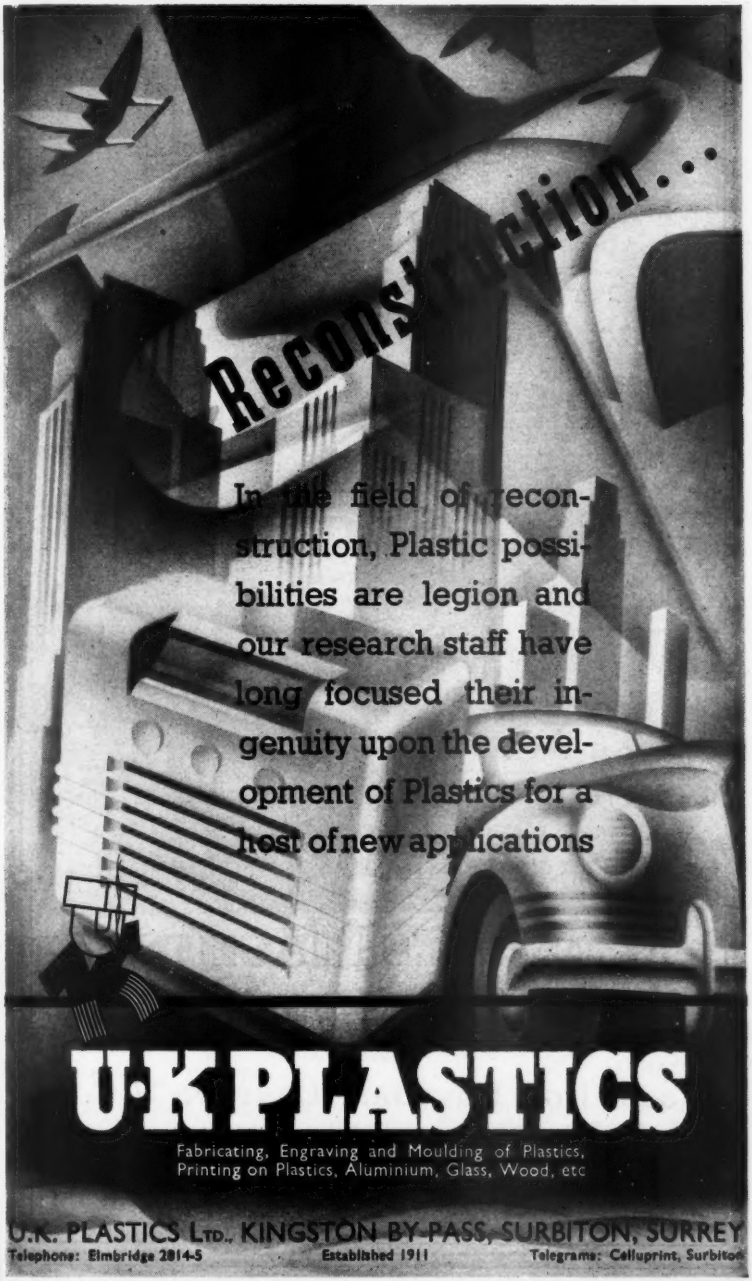
HERBERT TERRY & SONS LTD., REDDITCH

London, Birmingham, Manchester.

A CHANGE OF FACE...

WHEN THE EARLY EGYPTIANS went into the plastics business by moulding wax into face masks and effigies they didn't treat the matter very seriously . . . but modern man expects a great deal from the plastics industry. The complexities of Twentieth Century materials and improvements in processing call for constant progress in heating technique. Recent developments, for example, in high pressure gas burners for heating platens show advantages over steam heating of greater flexibility, cleanliness and economy. Different presses may work at different temperatures or with a temperature gradient across a given platen, if required. Complete combustion is obtained and gas consumption is strictly proportional to output. In warming and mixing processes, in heating of preforms, in moulding, curing and stoving, gas gives accurate, controlled temperatures at low capital and operating costs.

BRITISH GAS COUNCIL · 1 GROSVENOR PLACE · LONDON, S.W.1


Reconstruction...
In the field of reconstruction, Plastic possibilities are legion and our research staff have long focused their ingenuity upon the development of Plastics for a host of new applications
U·K PLASTICS
Fabricating, Engraving and Moulding of Plastics,
Printing on Plastics, Aluminium, Glass, Wood, etc
U.K. PLASTICS LTD., KINGSTON BY-PASS, SURBITON, SURREY
Telephone: Elmbridge 2814-5
Established 1911
Telegrams: Celluprint, Surbiton
R.P.1118B.

COMPLETE PLANTS

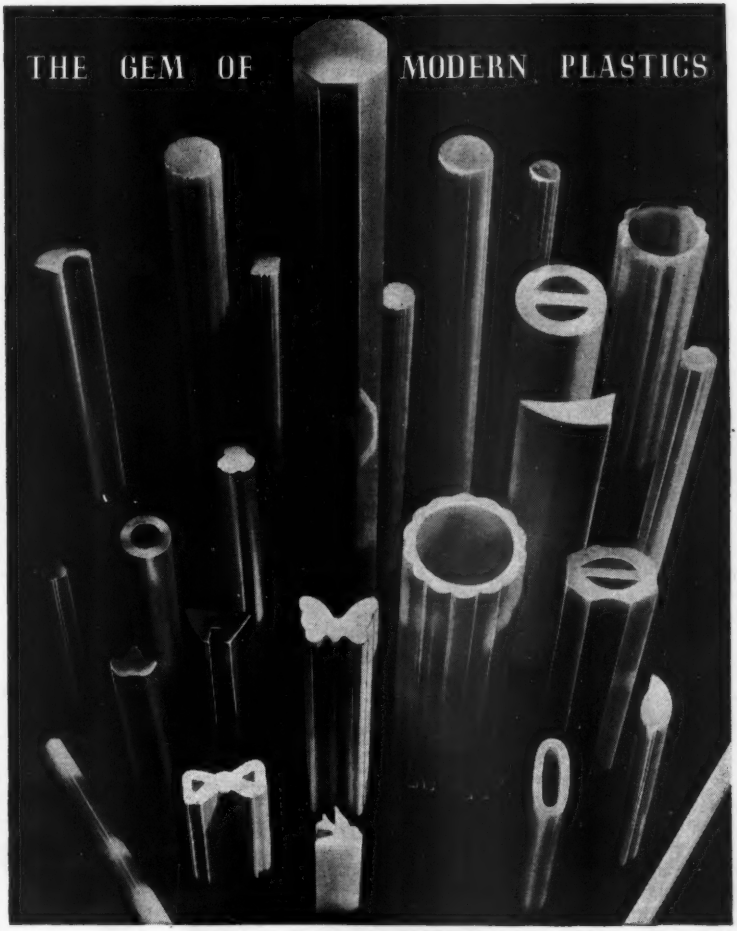
for

- Transparent Wrappings
- Film Casting
- Paper & Fabric Coating
- Solvent Recovery

FRENKEL'S MACHINES
(GT. BRITAIN) LIMITED.

329 HIGH HOLBORN, LONDON, W.C.1

TELEPHONE: HOLBORN 3842/9747



TELEPHONE
WALTHAM CROSS
3344

Catalin
TRADE MARK REGD

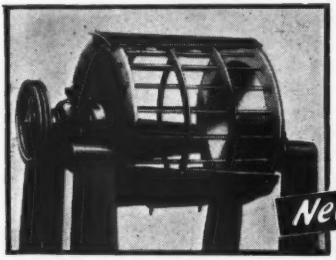
LTD. (Dept. P)
WALTHAM ABBEY,
ESSEX, ENGLAND

Catalin is a thermosetting cast synthetic resin plastic, available in a wide range of glorious colours and mottles — opaque, translucent and transparent. It is supplied in the form of rods, sheets, cylinders, and special profile sections and is freeworking, easily machined, with good physical and electrical properties; odourless, tasteless, non-inflammable and resistant to alcohol and most acids.
Catalin's technical staff are available for consultation on any production problem.
Your enquiries are cordially invited. 9

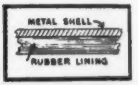
Wilkinson—Linatex announce

ENTIRELY NEW PRINCIPLE IN BALL MILL CONSTRUCTION

giving robust design and greater abrasive resistance



OLD METHOD. Rubber or porcelain lining was bonded or mechanically fixed to the internal surfaces of the drum. These methods have serious weaknesses, such as thickness and cost of porcelain linings and difficulty of maintaining a trouble-free bond in the case of rubber.



New method In the new Linatex Ball Mill, the rubber is not just on the surface, but forms an integral part of the drum, the barrel itself being composed of rings of Linatex rubber under compression—the ideal condition for abrasive resistance and durability generally. Tie rods embedded throughout its length in the rubber afford completely secure anchorage and robust structural design.

NO METAL EXPOSED INTERNALLY

PROJECTING METAL FINS (IN DIAMETERS ABOVE 2'0"
SERVE TO STRENGTHEN THE STRUCTURE & DISSIPATE HEAT

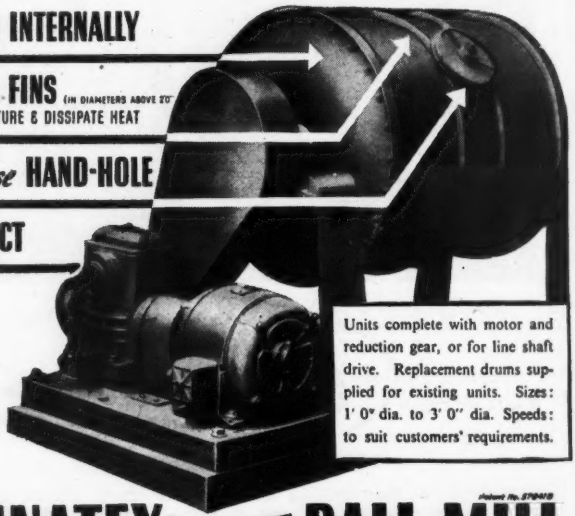
SPECIAL *Quick release* HAND-HOLE

LIGHT AND COMPACT

IDEAL FOR
PAINT INGREDIENTS, CERAMICS, PLASTICS etc.

WILKINSON PRODUCT

Write for illustrated leaflet.



Units complete with motor and reduction gear, or for line shaft drive. Replacement drums supplied for existing units. Sizes: 1' 0" dia. to 3' 0" dia. Speeds: to suit customers' requirements.

The new

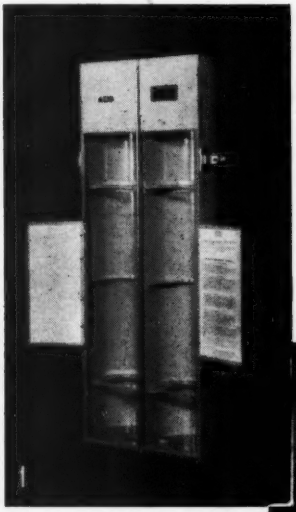
LINATEX RUBBER BALL MILL

Patent No. 579415

ALL ENQUIRIES TO

WILKINSON RUBBER LINATEX LTD PRIMLEY ROAD • CAMBERLEY • SURREY • Tel: Camberley 1912
Also in Canada, Australia, South Africa, U.S.A., India, Malaya, etc.

Also makers of Flexatex Hose, Linatex, Novatex, and the Linatex Pump.



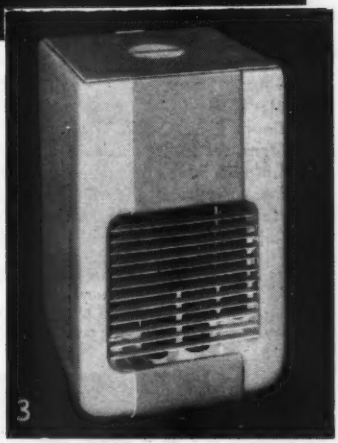
THERMO-PLASTICS LTD.

DUNSTABLE — BEDS.

Telephone: DUNSTABLE 686
Telegrams : THERMOPLASTICS DUNSTABLE

1 PORTABLE DEMONSTRATION CASE MADE FROM POST-FORMED LAMINATED BAKELITE SHEET FOR THE PERMUTIT CO., LTD.

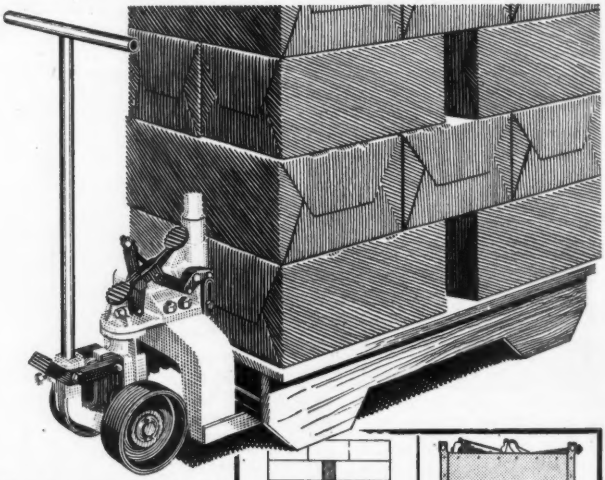
2 RADIO CABINET MADE IN COLOURED PERSPEX.



3 "CHEMICOOLER" MADE IN COLOURED PERSPEX FOR ARTIFICE LTD.

MOULDERS AND FABRICATORS OF ALL TYPES OF PLASTIC MATERIALS

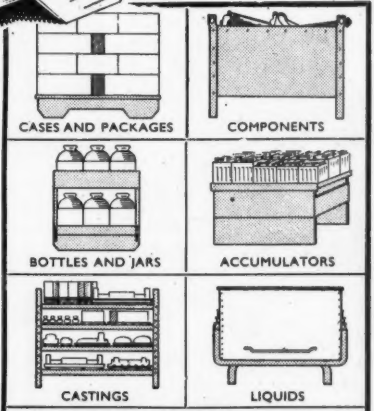
. . . it makes the floor move



With the Collis Truck one man does the work of a whole gang, because, in effect —it makes the floor move! Its use eliminates loading and unloading as separate operations. It makes use of the handling that is inseparable from previous or succeeding work. Goods are placed on a platform, instead of on the floor. The Collis Truck loads the platform, transports it easily and safely, and unloads it where required—*it makes the floor move!* There is a Collis Truck to handle every type of load up to 7½ tons. Special models designed to order.

write for illustrated catalogue

giving full particulars and, if desired, ask our Area Representative to call. J COLLIS & SONS LTD 45F REGENT SQUARE GRAYS INN ROAD LONDON WC1 : Phone TERm'nus 6141



COLLIS PLATFORMS are made to carry every type of load. A few representative models are shown above.

The Collis Truck

Ⓟ T.U

THOS. FIRTH & JOHN BROWN LTD. SHEFFIELD.

Tullis Russell & Co. Ltd.

Makers of

BASE PAPERS

for the

PLASTICS INDUSTRY

•

AUCHMUTY & ROTHES PAPER MILLS

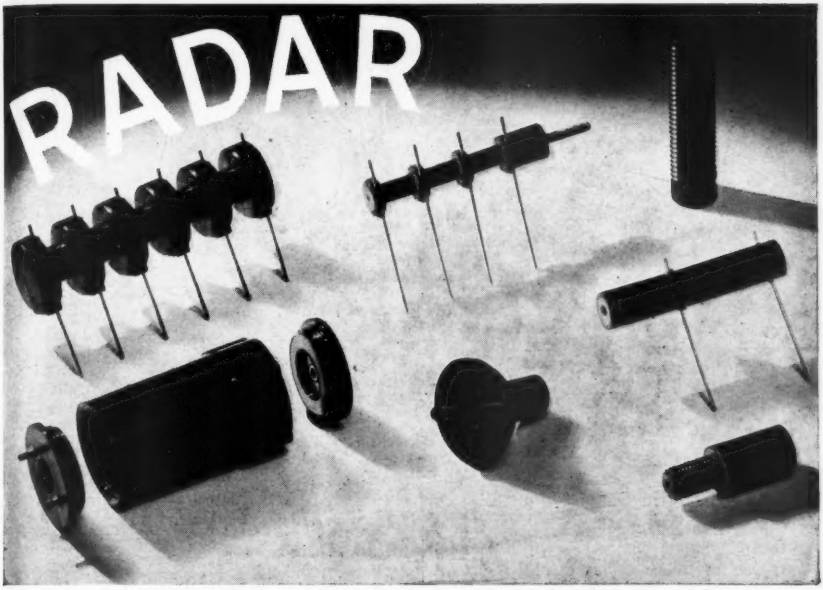
MARKINCH, SCOTLAND

LONDON
1 Tudor Street, E.C.4

MANCHESTER
372 Corn Exchange Buildings
Corporation Street

BIRMINGHAM
116 Colmore Row

Reg'd. Trade Mark

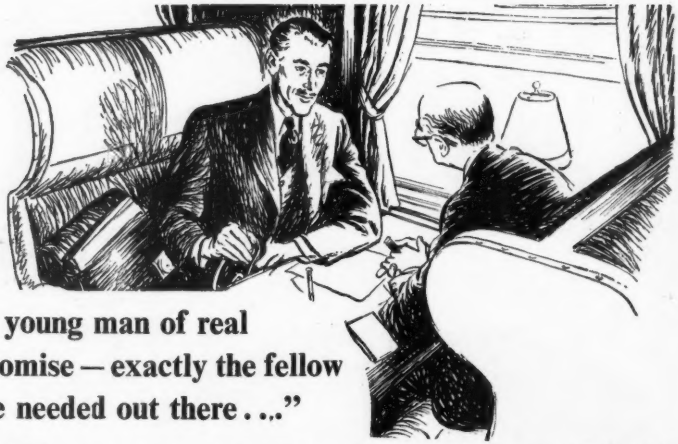


During the War we manufactured millions of Radar Plastic Components, most of which called for very fine limits, with a large percentage of them small and complex, but we were happy to deal with the problems they presented; our reward has been added experience which is available when considering your future plastic requirements.

DERWENT PLASTICS LIMITED

MINSTER MOULDINGS

STAMFORD BRIDGE YORK TEL 54 STAMFORD BRIDGE



"A young man of real promise — exactly the fellow we needed out there . . .."

'WE thought we were wonderfully lucky in finding him — but of course it was system, not luck. I've found, since, that the Appointments Offices take enormous trouble to 'screen' and classify applicants for commercial posts. In fact, they can give you a choice of excellent candidates in less time than it generally takes you, nowadays, to get an advertisement printed!

"What's more, all the Regional Appointments Offices are linked by teleprinter — it means that wherever the right man is registered, you hear of him. It helps him *and* the employer. In fact, if we had the time, we'd do just what they do for us — interview chaps all over the country, sort out their aptitudes and abilities, and end with a really good 'short list' to choose from. They use the very latest techniques of interviewing and assessing men and matching them with jobs.

"I'd recommend *any* employer who's looking for a high-grade man (or a dozen!) to notify his nearest Appointments Office *first*, wherever else he looks. There's the machinery, waiting to save him trouble, costing him nothing — and it's doing a grand job. . . ."

Hundreds of employers have commended the prompt and efficient service given by the fourteen Regional Appointments Offices. They are today's logical starting-point in the recruitment of high-grade staff, whether the need is for men and women already experienced and qualified, or for promising younger candidates to train.

Your nearest Appointments Office "matches men with jobs" in the executive, managerial, and administrative field. If you do not know the address, any local office of the Ministry of Labour will put you in touch at once. But for highly qualified technical and scientific personnel — engineers, scientists, architects, etc.—appointments are dealt with centrally, in London, by the specialist staff of the *Technical and Scientific Register*, York House, Kingsway, W.C.2.

Since VE-day, the Appointments Department has successfully filled over 49,000 responsible posts. If you have a staffing problem, your Regional Appointments Office is ready to help.

14 linked Appointments Offices cover the Nation's potential executive manpower

Issued by the Ministry of Labour and National Service, Appointments Department, 1-6 Tavistock Sq., London, W.C.1

The Greatest advance ever made in PLASTICS-PRESS DESIGN!

* Independent THERMOSTATIC CONTROL for each hotplate, with thermometers to indicate temperatures.
* RE-SETTING MECHANISM for bottom ejectors, can be operated without moving the ram.
* MECHANICALLY INTERLOCKED SAFETY GUARDS.
* BUILT-IN INTERVAL TIMER, to ensure accurate and uniform timing.
* ELECTRICAL SWITCHGEAR & CONTROLS totally enclosed for safety.
* ONE LEVER controls both opening and closing movements of the press.
* Totally enclosed HYDRAULIC SYSTEM prevents ingress of moulding flash, dust, etc.

No other Press has all these advantages!

The Turner Plastics Press is completely self-contained. It provides any required pressure between 10 and 50 tons, and is installed by making a single connection to the electrical supply. Fully descriptive literature gladly sent on request.

The TURNER PLASTICS PRESS

TURNER MANUFACTURING CO. LTD., WULFRUNA WORKS, VILLIERS STREET, WOLVERHAMPTON

Pioneers of History

CHRISTOPHER COLUMBUS. Made the first journey to America in 1492, thus opening the gateway to the Western Hemisphere. Truly a pioneer of History!

We too, can claim to be pioneers in Plastic Moulding and place at your disposal a vast amount of knowledge gained in the hard school of experiment and experience.

Bring your moulding problems to us. All enquiries treated in the strictest of confidence.

ROBERT McARD & CO. LTD.

CROWN WORKS • DENTON • MANCHESTER

Pioneers IN MOULDED PLASTICS

LAUDATOR·TEMPORIS ACTI

As you might say—

Soft ! That's what you kids is nowadays. When I was a little squiddlum I had to put the nuts on with box spanner and tommy bar ; turning and heaving until me pore little arms was fit to bust and me pore little knuckles bleeding. Did anyone care ? Only my Mum. They tried me with a Power Tool but when I tried to lift it me pore little legs gave way. A hard life—but it made a man of me.

And then this bloke invents this 'ere tool. Doosooter it's called and don't ask me to spell it. Light ! A baby can use it. *You* can use it. You with your legs like a sparrer's and your arms like a couple of bent straws. *You* won't get no bleedin' knuckles. *You* won't go 'ome cryin' for tiredness and fall asleep with your face in your supper. Soft ! That's what you'll be. Just a pore little squiddlum ! I'm sorry for you, son, I am. Straight ! You bin born too late.

DESOUTTER *Specialists in Lightweight, Pneumatic and Electric Portable Tools*

Desoutter Bros. Ltd. (Dept. S), The Hyde, Hendon, London, N.W.9. Telephone : Colindale 6346-7-8-9.

C.R.C.169

The Schori Roving Reporter writes:

Flame sprayed Plastics

GIVE A TOUGH, DECORATIVE FINISH TO ANY SURFACE

Plastics such as Polythene, Thiokol, some of the Vinyl resins, also Shellac, Ebonite and Sulphur, are being sprayed with astonishing success by the Schori flame pistol. They can be applied to any surface with the speed and ease of paint spraying. Applied without solvents, they give hard, brilliant, crack proof coverings of considerable thickness which need no stoving.

Suitably pigmented, Schori sprayed plastic finishes are as decorative as they are practical and protective. Architects, builders, manufacturers, shipbuilders, structural steel makers, etc., are finding them the modern answer to their finishing problems.

Schori sprayed Polythene gives a tough, non-chipping finish to steel furniture.

Licensees throughout the Country.

Schori METALLISING PROCESS Co.

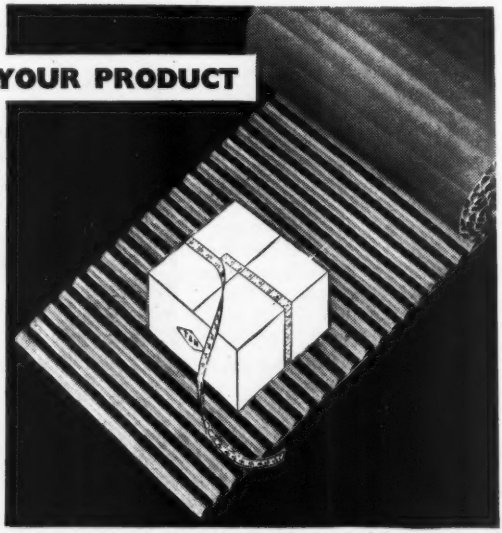
SCHORI METALLISING PROCESS LTD., BRENT CRESCENT, NORTH CIRCULAR RD., LONDON, N.W.10. Phone: ELGAR 7393

GD29

NEW SUIT FOR YOUR PRODUCT

Get it sized up now!

Now, while marketing plans are being formulated, is the time to go into your packaging problems. A good pack is an insurance and an advertisement. It can reduce breakage and pilfering losses. It can save weight and bulk and so reduce freight and storage costs. Thompson & Norris are *the* pioneers in the scientific use of corrugated fibre-board for packing. They can help in designing a made-to-measure pack for *your* products. Put it in hand *now*.



THOMPSON & NORRIS

CORRUGATED FIBRE-BOARD PACKINGS

T&N

The Thompson & Norris Manufacturing Co. Ltd., Great West Road, Brentford, Middx.

Telephone: **Ealing 4555** · *Factories also at:* **Birmingham; Histon, Cambs.; and Edinburgh**

SPECIAL NICKEL CHROME STEEL FOR MOULDS

This quality is now offered for the first time as a free-cutting type without, however, impairing its well-known physical properties. Supplied in the ready heat-treated state for short runs, or in the annealed state for subsequent hardening, tempering and plating for long runs. After machining a high degree of polish is attained.

OUR OTHER SPECIAL MOULD STEELS ARE

K.E.A28. *For long runs, when using corrosive powders. This is a special stainless mould steel.*

K.E.961. *For long runs, having special resistance to abrasion. Expressly designed for the most accurate mould work. Possesses deep hardening qualities in oil or air with minimum distortion. Will not shrink in use and takes a hard mirror polish, which will not easily tarnish.*

K.E.169. *Presents a particularly hard surface after case-hardening. Polishes well and has a high core strength.*

K.E.970. *Particularly dense alloy steel for Master Hobs, etc.*

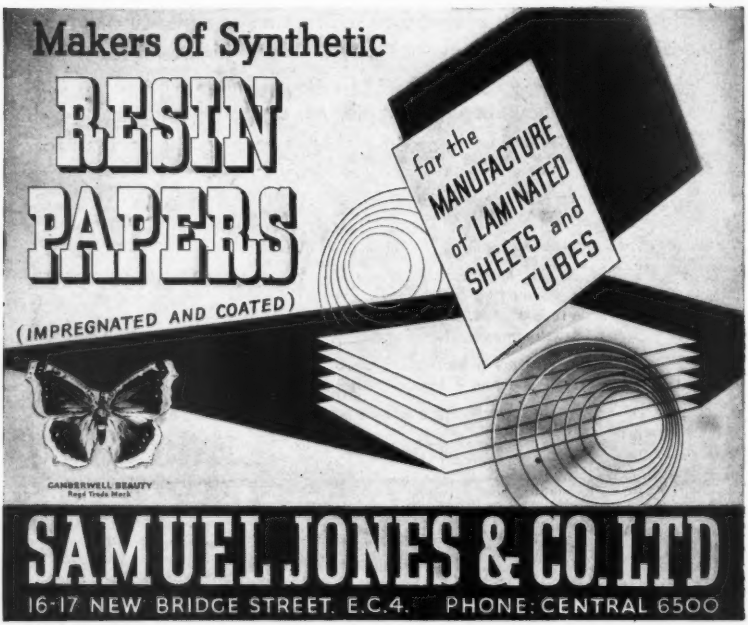
We specialise in the manufacture of all types of Precision Ground Steels to the finest limits to meet the needs of modern automatic production.

KAYSER ELLISON & CO. LTD.

CARLISLE STEEL WORKS, SHEFFIELD. EST. IN 1825

London Stockists (except for Stainless Steels): FARMER, STEDALL & CO., 145-157, St. John St., Clerkenwell, E.C.1
London Stockists for Stainless Steel : MACREADY'S METAL CO., LTD., 131-135, Pentonville Road, London, N.1

TECHNICAL DIVISION
NON-TECHNICAL DIVISION
Durastrip
Durathread
Duratube
for these and many other applications
Sole Manufacturers: DURATUBE & WIRE LTD., FELTHAM, MIDDSX., ENGLAND


Makers of Synthetic
RESIN PAPERS
(IMPREGNATED AND COATED)
for the MANUFACTURE of LAMINATED SHEETS and TUBES
CAMBERWELL BEAUTY
Regd Trade Mark
SAMUEL JONES & CO. LTD
16-17 NEW BRIDGE STREET. E.C.4. PHONE: CENTRAL 6500

● **PROMPT DELIVERIES.** Estimate, Design and Layout on request.

P.V.C. PLASTICS OF ALL KINDS
Plastic Cloth (Embossed or Plain), Pressed Sheet, Fine Calendered Sheet, and Extrusions.

BRITISH MOULDEX RUBBER Co., Ltd.

2 CAXTON ST., WESTMINSTER, LONDON, S.W.1
Phone: ABBey 3252-3

MANCHESTER: ROYAL LONDON HOUSE, 196 DEANSGATE
BIRMINGHAM: 299 BRADFORD STREET

D

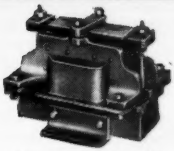
HORNFLOWA LTD., PLASTICS BUTTONS, MARYPORT, CUMBERLAND

Complete control from first to last . . .

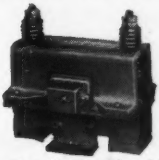
Efficient production calls for dependable feed. The reason SYNTRON Electric Feeders and Vibrators pay for themselves in so short a time is that they give *complete* control of the material — wherever it is needed. In the example illustrated, control is applied first as material flows from the hopper, by means of a rheostatically-controlled SYNTRON Vibrator, and also as it passes through the Vibra-Flow Conveyor, where it is agitated by a second vibrator. A steady, even flow to the mixers, grinders, driers, scales or containers is thus ensured.

SYNTRON ELECTRIC FEEDERS & VIBRATORS

'Noiseless' Model V15



Heavy Duty Model V55



Heavy Duty Models V75 and V125

The technical staff of International Combustion Ltd. are always ready to bring their exceptional experience to any material handling problem.

INTERNATIONAL COMBUSTION LTD

C29 NINETEEN WOBURN PLACE · LONDON · W.C.1 · WORKS: DERBY

Point FOUR

IN CONSIDERING PLASTICS

BEAUTY OR PRECISION? **If your plastic moulded part calls for beauty of design and colour, or is for an engineering product governed by precision limits, plastic mouldings will meet these widely differing requirements.**

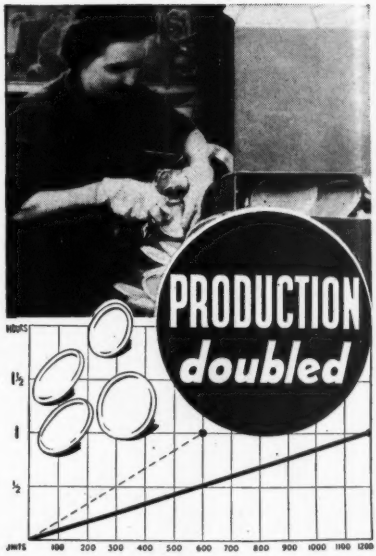
BUT you should always invite the co-operation of Specialists in the initial stages of the design. Advice is also necessary regarding the type of plastic best suited to the characteristics of the job and data on the most economical and time-saving methods of production.

Crystalate's long experience and high reputation for service to their Customers make an approach to them worth while for the clarification of all plastic moulding problems.

CRYSTALATE

PLASTIC MOULDERS & TOOLMAKERS SINCE 1899

Crystalate Ltd., Golden Green, Tonbridge, Kent. Phone: Hadlow 233/4/5 (20 lines)



THANKS TO GIB

Mk. 1. GIB Precision Vacuum Chucking Machine operating in the Plastics Division of E. K. Cole Ltd., Southend-on-Sea.

This GIB Vacuum Chucking Machine is trimming plastic mouldings at the rate of 1,200 per hour. Before its installation the rate was 600 per hour—thus GIB doubled output, saving both time and labour.

GIB precision for industry can increase production for you also—contact us regarding its application to your own special problem.

GIB *precision for industry*

Proprietors: B.G. (London) Ltd., 17-19, Stratford Place, Oxford St., London, W.1. Tel: MAYfair 1585-7.

Works: Barton Lane, Cirencester. Tel. Cirencester 726.

How can **H.F. HEATING** *help?*

A new G.E.C. publication, "Process Heating by High Frequency Valve Generators," based upon extensive research by G.E.C. technicians, provides up-to-date technical information on valve-operated generators of 100 watts to 25 kW. output for both dielectric and eddy current heating.

Copies are available on request to Dept. P.

G.E.C.

THE GENERAL ELECTRIC CO., LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

A NEW IDEA for your EXPORT DEPARTMENT

Visible Control of All Orders and Relevant Documents

FULL DETAILS FREE ON REQUEST

Below you will find details of Shannograph —the system that has revolutionised modern filing (and finding).*

One of its many specialised applications is for Export.

By using Shannograph all relevant papers, documents and correspondence can be safely co-ordinated for constant reference.

Each stage of progress is visually charted for at-sight reference—so that you can glance down a long list of Export orders and see at once which orders have been confirmed, delayed, are due or overdue for action, what the position is regarding letters of credit, shipping arrangements, etc.

The system can be used whether you file numerically, alphabetically or by any other method.

The full-width, flat-top Shannograph files permit the maximum of visual information, plus the necessary colour-charting and signalling for foolproof accuracy.

Being SUSPENDED filing, Shannograph gives neat, quick operation, simple handling, full protection to documents, and long-life with low overhead costs. Once each order is completed, the box-like folders can be used over and over again for other Export orders or similar specialised purposes . . . because Shannograph simply cannot become battered, worn, dog-eared or dilapidated.

There are many other such specialised purposes for Shannograph *in addition to* the filing of correspondence, invoices, works orders, etc. Advertising managers can control copy dates, proofs, etc.; sales managers can control and co-ordinate products, territories, salesmen, etc. In fact, responsible executives of most departments will find that Shannograph filing solves more than one organisational problem . . . Make enquiries and see . . .

Shannograph will operate in YOUR EXISTING CABINETS, DESK DRAWERS, etc., OR AS INDEPENDENT UNITS.

* SHANNOGRAPH: Flat-top, full-width, box-like folders of extra strength, mounted on metal suspension on metal frames. Obtainable in quarto or foolscap sizes. For use numerically, alphabetically, chronologically, geographically, in series or separately. Colour-charted so as to make errors impossible . . . The "new technique" in filing and *finding*.

Shannon Systems

THE SHANNON LIMITED
426, Shannon Corner, New Malden, Surrey

DURESTOS REGISTERED *the new asbestos felt moulding material*

has exceptional strength

The accompanying figures for mouldings of "Durestos" (RA.1) moulding material show its exceptional strength; "Durestos" possesses also high heat resistance and dimensional stability. For strong acid and chemical conditions, a special grade (RA.3) is available.

For mouldings, flat sheets, rods and tubes use "Durestos."

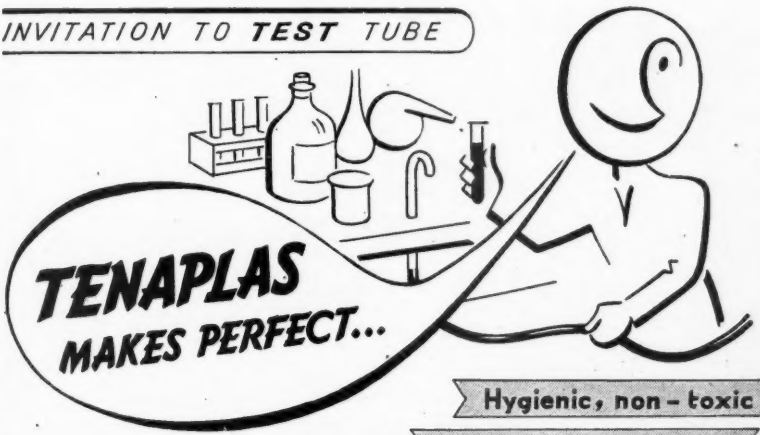
For further particulars write to—

GRADE RA.1	
Tensile strength	lb. sq. in.
Direction A	29,000
Direction B	19,000
Compressive strength	
Edgewise	16,000
Flatwise	78,000
Impact strength mean for unnotched ½" x ½" Izod	Direction A Flatwise 8·2 ft. lb. Edgewise 5·9 ft. lb.

TURNER BROTHERS ASBESTOS COMPANY LIMITED · ROCHDALE

AF2

INVITATION TO ***TEST*** *TUBE*

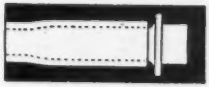


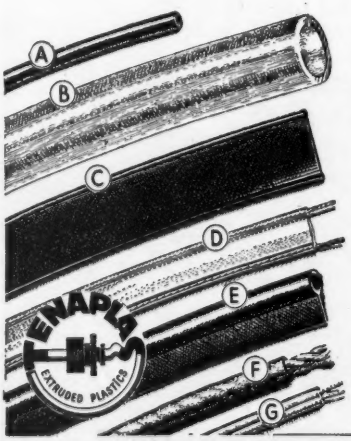
TENAPLAS MAKES PERFECT...

Hygienic, non-toxic odourless tubes for conveying most liquids

TENAPLAX is the name of this Tenaplas triumph in plastic extrusion. Odourless, non-toxic, hygienic—its glass-smooth finish keeps it permanently clean. Non-inflammable. Imperishable. And remarkable for tensile strength. It gives constant electrical insulation — withstands temperatures from —20°C. to +75°C. — resists almost all acids and corrosives under normal temperatures. In laboratory or factory — put TENAPLAX on trial. And count its many blessings!

● *TENAPLAX is made in continuous extruded lengths. The only jointing is at actual connecting point. Diagram on right shows end of tubing over tight-fitting Tenaplax connector.*





TENAPLAS PRODUCTS INCLUDE

(*a*) **TENATUBE** for wire sleeving; delivery of liquids.
(*b*) **TENAPLAX** for conveying liquid foodstuffs and chemicals.
(*c*) **TENATAPES** for haberdashery and trimmings.
(*d*) **TENAWIRE** Twin Flat; single and multiple.
(*e*) **TENATRIMS** for motor-car coachwork and upholstery.
(*f*) **TENAROPE** for clothes-lines, sash cord and many other uses.
(*g*) **TENAWIRE** Twin Flex, and other wires for many uses.

Tenaplas
Extruded Plastics
IN ANY DIMENSIONS REQUIRED

TENAPLAS LTD • UPPER BASILDON • Nr. PANGBOURNE • BERKS.
Phone: Upper Basildon 228 & 269 · Cables: Tenaplas, Reading · Code: Bentley's, 1st Edition · Agents throughout the world

T.P.8P

Finest Quality

P.V.C.
SHEETING

In every variety of colours, including metallic shades, translucent and printed sheets.

G.R.L *Plastics* **LTD.**

Telegrams:— *Elgarcon, Ave., London.* **58, FINSBURY PAVEMENT, LONDON, E.C.2.** *Telephone:—* *MON. 9737*

POWER CRISIS!

Daily Telegraph 23/4/47

24-HR. SPREADOVER OR BIG POWER CUTS FOR 3 YEARS

BOARD WARNS MR. SHINWELL

By HUGH CHEVINS,
Daily Telegraph Industrial Correspondent

Electricity load shedding on a greater scale and over longer periods than ever will be unavoidable for the next two or three years with more dislocation of industry, unless the demand for power is spread more evenly over the 24 hours.

This warning to Mr. Shinwell, Minister of Fuel and Power, is given by the Central Electricity Board in its report for 1946 issued to-day. The report is addressed to the Minister as it is hoped a substantial transfer of industrial activity is [illegible] made by [illegible]

Reproduced by kind permission of the "Daily Telegraph."

THE urgent necessity for private generating plant to meet these restrictions is being met by production of standardised Diesel alternator sets of 330, 100, 75 and 65 kVA capacity under a Ministry of Supply scheme which provides for high priority release of the materials needed to achieve

★ SPECIALLY EARLY DELIVERY!

These power units are exceptionally compact and comprehensive and fully in accordance with modern practice for stationary generating plant. Approximate prices for the four sizes, including switchgear, etc., and radiator cooling:

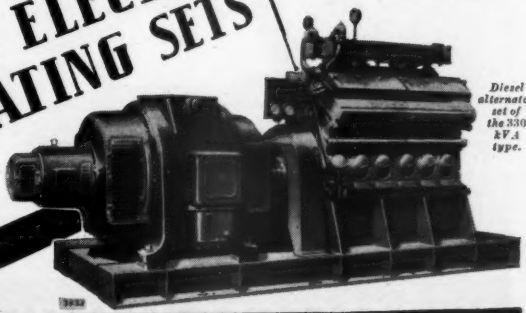
330 kVA	**-**	**£6,900**
100 kVA	**-**	**£3,100**
75 kVA	**-**	**£2,700**
65 kVA	**-**	**£2,270**

Full details will be supplied on application to Dept. PL. and hire purchase can be arranged if desired.

PAXMAN

Self-contained

DIESEL ELECTRIC GENERATING SETS



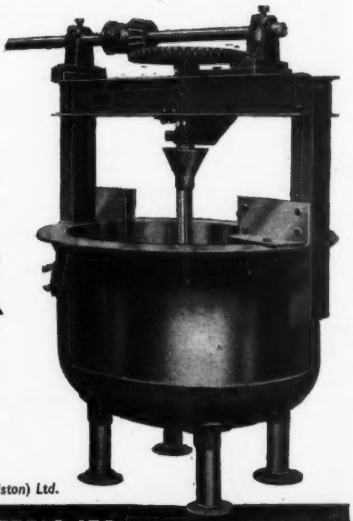
Diesel alternator set of the 330 kVA type.

DAVEY, PAXMAN & CO. LTD., COLCHESTER

(ASSOCIATED WITH RUSTON & HORNSBY LTD., LINCOLN)

"Staybrite"

is much used in making PLANT FOR PLASTICS



"Staybrite" steel jacketed pan of 100 gallons capacity for moulding powders, tested to a pressure of 100 lbs. per square inch.

Photo by courtesy of Thompson Brothers (Bilston) Ltd.

FIRTH-VICKERS STAINLESS STEELS LTD SHEFFIELD

CORNERCROFT DO THE WHOLE JOB

Avoid bottlenecks in the supply of moulded plastic components by giving the whole job to Cornercroft. We do everything from the making of the mould to quantity production of the moulded parts by compression, transfer or injection processes.

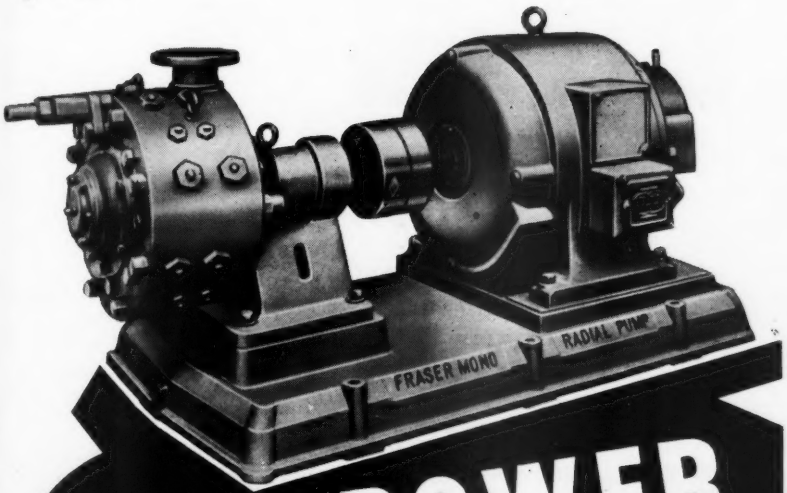
Members of: The Gauge and Toolmakers' Association.

CORNERCROFT (PLASTICS) LTD.

subsidiary of Cornercroft Ltd. ACE WORKS, COVENTRY

CPL11

The **POWER**



behind **POWER**

ANDREW FRASER & CO. LTD.

ASTOR HOUSE, ALDWYCH, LONDON, W.C.2

Telephone : HOLborn 2995/6 Telegrams : Monorad, Estrand, London

"MONO-RADIAL HYDRAULIC PUMPS AND CONTROL VALVES"

F

MONSANTO CHEMICALS

FOR THE PLASTICS INDUSTRY

PHENOL★ . . . CRESYLIC ACIDS . . . PHTHALIC ANHYDRIDE★ (flake) . . . DIETHYL PHTHALATE . . . DIMETHYL PHTHALATE . . . DIBUTYL PHTHALATE . . . AROCLORS (chlorinated diphenyls) . . . SANTOLITES (speciality resins) . . . SANTICIZERS (speciality plasticisers) . . . FIBESTOS (cellulose acetate) . . . BENZOIC ACID . . . SALICYLIC ACID.

★ In Great Britain Monsanto are, by far, the largest manufacturers of phenol and the only manufacturers of phthalic anhydride to produce phthalate esters from their own, closely controlled, raw material.

Unfortunately many of the above products are temporarily in short supply. In the meantime, however, we welcome your enquiries and will be glad to give you full information on present and future availability.

MONSANTO CHEMICALS LIMITED • LONDON • SW1

Vol. XI. No. 121. JUNE, 1947

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

Proprietors - - **TEMPLE PRESS LIMITED**
Managing Director - **ROLAND E. DANGERFIELD**

Editor - - **M. D. CURWEN, B.Sc., A.R.I.C.**
Offices - **Bowling Green Lane, London, E.C.1**

CONTENTS

	Page
Editorial	282
Durestos	285
Paper of High Wet Strength, by Dr. I. Bursztyn ..	287
Plastics Aids to Navigation ..	293
World's Industry Employs Plastics	294
Plastics at Earls Court ..	297
Infra-Red Heating in Shaping Methyl-Methacrylate Sheet	309
Cellulose Acetate Plastics, by Vivian Stannett	314
Book Reviews	319
Letters	320
Production News	323
New Productions from the Moulding Shop	325
Patent Review	327
Microscopic Examination of Plastic Materials, by J. H. Wredden	329

NOTICES

"PLASTICS" is published in London, England, on the second Wednesday of the month.
Annual subscription rate, 25/-. Shorter periods, pro rata.

All instructions, matter and passed proofs of all kinds of advertisements must reach the Head Office of "PLASTICS" by the first of the month to ensure insertion.

Head Offices:
Bowling Green Lane, London, E.C.1.
Inland Telegrams - - "*Pressimus, Phone, London.*"
Cables - - - - "*Pressimus, London.*"
Telephone - - *Terminus 3636 (Private Exchange).*

Midland Offices—5, Suffolk Street, Birmingham, 1.
Telephone - - - *Midland 4117-8.*
50, Hertford Street, Coventry.
Telephone - - - *Coventry 62464.*

Northern Offices—1, Brazennose Street, Manchester, 2.
Telephone - - *Blackfriars 5038-9.*
Telegrams "*Presswork, Manchester.*"

Scottish Offices—12, Renfield Street, Glasgow.
Telephone - *Glasgow Central 9036.*

EDITORIALS

Young Lady with Medals

IN 1926 or thereabouts we saw our first plastics exhibition, then, we believe, an offshoot of the chemical exhibit at the B.I.F. It was woefully small, but, even then, made up for smallness by its colour and the wonderful moulded objects (most of them were for the electrical industry, its largest customer). Both attracted large crowds, for were not the goods made from synthetic resins, the raw material of the future?

We used these words glibly enough, too glibly perhaps, but, fundamentally, they have proved to be true, for to-day they provide not mere replacements for temporarily vanished traditional materials, but sound proven structures for the electrical, engineering, chemical, shipbuilding, aircraft and automotive industries, which are the true testing-houses of all structural materials.

In 1947 the plastics industry has shown its medals at the British Industries Fair; many of them won during the war years, because of the intensive demand for non-metal structures, coatings, sheets and so on, and because of the concentrated research that is always carried out during such periods.

The stands themselves were, on the whole, beautifully constructed, and for that reason appeared larger than they were, with exhibits more tastefully and clearly defined. Some were rather frigidly austere, and some were too crowded with goods, which, nevertheless, is no deterrent to the serious and urgent buyer.

We do not know how many of the half-million visitors who passed through the turnstiles of the Fair found their way to the Plastics Section, but at our own stand, which appeared to act—as we wanted it to act—as an inquiry bureau to the rest of the show, our visitors included great numbers from most European countries, and a very healthy proportion from Canada, South Africa and even from far-off Australia. Most requests were for finished goods of the fancy goods and sheeting type, while the home demand, especially from the north, the information sought was more technical in nature, and for the heavier industries, such as engineering.

The great difference between this and previous exhibitions lies in the parallel difference of available raw materials that has taken place in the past eight years. In 1939 most exhibits were confined to mouldings, and, of these, the "technical" moulding reigned supreme. To-day, the production of thermoplastic sheet and extrusions, especially in polyvinyl-chloride, is a major affair, replacing not only textiles but leather. Hence we see the growth of not only manufacturers of the semi-finished raw material, some half-dozen extruding concerns and a dozen or more calendering concerns, but also the creation of embossing and otherwise surface decorating and "printing-on plastics" factories. Certainly this section appeared to draw more visitors than—as some suggest—is warranted by its relative importance in the whole industry of plastics. "Relative importance" are strange words to use in an ever-changing world, especially since we are in process of improving the quality of sheet and on the eve of the introduction of newer thermoplastics generally approved to be "stronger and better" than p.v.c. Indeed, some are already on the market and merely await technical development. Much of the attraction to sheet materials is no doubt due to vast public demand as distinct from the more careful technical demand for thermosetting mouldings by industry. Nevertheless, thermoplastics have developed economically in recent years at a greater rate than the thermosetting type, and can hardly recede in favour. This does not prevent us from regarding the latter section of the industry as being the more fundamentally

important. It is so tied to the heavier industries which we regard as arbiters of sound structural forms that cannot but provide the basis for standards that promote the fortune of the whole.

Even so, thermoplastics are far from being raw materials only for fancy goods, textiles and so on. At the stand of I.C.I. we had the new "Transpex" plastics which, made into lenses, are transforming our ideas on television and on television apparatus production. If most of us have seen only lampshades of this company's polythene sheet and a few moulded items of the same plastic for electrical goods, we can also rest assured that its possibilities are very great.

So, too, we see new important growths from p.v.c. as at British Resin Products, Ltd., stand, where special pastes, developed by this concern, were on view to show the creation of a new shoe manufacturing technique by their means. Here, too, was a new elastic type of mould made from the same p.v.c. pastes.

As an example of expansion in a similar field, we may also cite Vinyl Products, Ltd., who, starting with p.v.c. sheet, have developed enormously with allied products far removed from the sheet industry. At their stand were shown a wide range of vinyl products of great technical value. Thus polyvinyl alcohol in gel form and made into a solution with water for spreading, has proved to be an admirable base for the manufacture of greaseproof paper and of protective clothing, of adhesives and of photo-sensitive coatings instead of gelatine. Polyvinyl acetate emulsions (inflammable solvents are thus completely avoided) provide adhesives for paper, wood, glass, etc., and is admirably useful for bonding leather fluff and textile wastes. Of special interest, too, at this stand were the acrylic emulsions of two types: the negatively charged emulsions which are used for leather finishing and leather surface sealing, and the positively charged emulsions so useful during finishing and dyeing of textiles which are usually negatively charged. Because of efficient penetration, these resins are eminently suitable as finishing agents.

Thermosetting Resins

EXCEPT where they have contact with the public demand as radio cabinets, household and kitchen goods, etc., these resins have not the visual appeal of the thermoplastic resins. This is another way of saying that in general the thermoplastic resins find their greatest application in public usage, and that the thermosetting resins, with the exception of the urea resins, generally find their way to industry as components of other and larger constructions, where their use is strictly utilitarian and colour of little value.

But it is very certain that it is in the moulding of the thermosetting resins that we find the most admirable work from the strictly technical standpoint and there was much to admire at the Fair stands of those companies who take a pride in the accomplishment of high engineering standards. And if we may say so, it is no easy matter in these days of short supply of raw materials whose quality is not yet up to pre-war standard, to work to official specifications. Yet we did see such fine work at the stands of such stalwarts of the industry, Fraser and Glass, Ltd., Insulators, Ltd., Ebonestos, Ltd., De La Rue Plastics, Ltd., Crystallate, Ltd., and so on, where electrical units form the masterpieces and engineering, motorcar and aircraft parts are runners-up.

Not that these concerns confine themselves to "heavy stuff." Indeed, far from it, for at least one of them produces that strange musical instrument called a recorder far more accurately than had been done before the advent of plastics. Furthermore, one or more of them makes pipes from phenolic resin. Not bagpipes or stove-pipes or gas-pipes, mark you, but pipes for smoking tobacco. Shades of Raleigh! We have seen them, but like the man who doubted the existence of a giraffe when he saw one, we don't believe it. We suppose some learned person has gone into the matter thoroughly and is convinced that this is a case of "fitness for purpose" we talk so much about.

The use of thermosetting resins for other than moulding purposes grows apace. At the stand of the B.I.P. group was an entirely novel application—the production of horse-cart shafts from laminates bonded with Beetle resin. Apparently, a famous milk-distributing concern has adopted this method of producing better and stronger shafts in a wood-starved world. At the stand of British Resin Products, Ltd., there was shown the biggest step yet in the adoption of synthetic glues to the construction of naval craft. We saw much of this work begun just before and during the war, but here (in photograph display) was what must be a major construction. Carried out by a well-known firm of naval constructors, the vessel is still on the secret list, but at any rate we can congratulate all concerned.

While discussing construction jobs, Holoplast, Ltd., deserve special mention. The unique form of " phenolic " laminate made by this company has been widely adopted by shipbuilders and indeed the early work for the construction of bulkheads and the like was carried out for the Admiralty. At the British Industries Fair this concern's stand eschewed examples of naval and other ship construction to show their material and instead gave us an entire chemical laboratory built of it. This is indeed " fitness for purpose," since both in the hollow structure of Holoplast for building up the cupboards, and the single sheet for floors and bench tops we have an excellent, robust material for withstanding the action of most chemicals which can readily be washed down.

In a different category, but still concerned with phenolic impregnated sheet, we were intrigued with the exhibit of Dufay-Chromex. Dufaylite is a honeycomb structure of great strength and lightness. Although so new to the industrial world, it is already widely used in aircraft and other structures.

What was much more to the point was the use by Barclay-Stuart (Plastics), Ltd., of string-filled Rockite for the production of trays. Not very colourful perhaps but of very high impact strength. The resin is not easy to mould, but we wish more moulders would use it.

Finally, we cannot but heave a sigh of relief at seeing at the stand of British Artid plastics, the use of melamine resins for the production of kitchen ware. No doubt very much in short supply, we welcome these moulding powders as an additional raw material.

Roll Out the Barrels

WE have not forgotten the 20-gallon beer barrel on the stand of British Resin Products, Ltd., made by Merron, Ltd., of Bow, from laminates joined with Rockite resins. An excellent piece of work. Strong barrels for strong beer! There can be little doubt that the barrel in question is more expensive than the normal type at present, and we shall follow progress with interest, since so many other industries with indeed an urgent need for acid- or alkali-resisting containers have a greater claim than the brewing industry for the expenditure of such resins. On the other hand, there is less anxiety for " returns."

Another type of barrel of great urgency is that for the herring industry, which approached us for suggestions for the use of plastics. In view of the enormous demand, we suggested, in addition to the laminated type, a simple structure made from polythene, preferably of the thickness and strength of Crinothene. The body could be made as a simple cylinder from sheet, hot-gas welded at the joint, with base and cylinder similarly welded. When filled with herring, we believe the structure would resist crushing well, since the fish would exert fluid pressure.

Cost would not be excessively high, and, after arrival and emptying, the containers could readily be cut up again and returned in closely packed form. Alternatively, these might be used as plastic sheet in the country of receipt and so form a valuable export.

We have had no enthusiastic response to this idea from the herring industry, so presume it is not so brilliant as we imagined!

DURESTOS—A New Plastic Material for Moulding and Fabrication

THE world of plastics may be viewed as an expanding background in which progress in the established raw materials and processes goes on steadily, while in the immediate foreground scintillate more brightly the newer discoveries that eventually become one with the general scene as and when they form part of the whole.

We have just received the first examples of the newest of these stars with considerable enthusiasm, for it is in a form that is completely new and fills one of the lacunæ that have long existed in the complete repertoire of the plastics moulding and forming industry.

It is a soft, felt-like material manufactured by impregnating asbestos sheet with phenolic resin in such a condition that the felt remains soft and uncured for a considerable period. The manufacturers, Turner Brothers Asbestos Co., Ltd., of Rochdale, Lancashire, inform us that the policy of the company is to supply the felt in its uncured state to moulding and fabricating firms. "Durestos" is thus a semi-raw material for the plastics industry.

The new material is available in three grades: high tensile, general purpose, and acid-resisting, produced from blue (crocidolite) asbestos. Standard sheets are 50 ins. by 47 ins. approximately, but if necessary sheets 100 ins. long can be supplied. The standard thicknesses are 0.016, 0.031 and 0.063 in.; these figures represent the ultimate thicknesses after curing under pressure, the bulk factor being 1.7.

The chief characteristics of "Durestos" are outstanding strength; strong resistance to most chemicals and acids; high heat and flame resistance (high tensile and acid-resisting grades are unaffected by temperatures up to 200 degrees C.); dimensional stability; and 100 per cent. resistance to mildew, bearing journals, bushes, gears, etc., made of "Durestos" being unaffected by the most humid conditions.

Table 1.—Properties of "Durestos" Felt Moulding Material (Sheets)

Grade		High tensile	General purpose	Acid resisting
Sp. Gr.		1.75	1.65	1.90
Tensile strength (min. ult.) lb./sq. in.	Direction A	29,000	22,000	23,000
	Right angles to A	19,000	13,000	13,000
Compressive strength (min. ult.) lb./sq. in.	Edgewise	16,000	15,000	16,000
	Flatwise	78,000	64,000	78,000
Shear strength (min. ult.) lb. sq./in.	Flatwise	19,000	16,000	19,000
Gross breaking strength (min. of edgewise and flatwise) lb./sq. in.	Direction A	24,500	23,000	24,500
	Right angles to A	21,000	20,000	21,000
Impact strength (mean for unnotched ½ in. × ½ in. Izod) ft./lb.	Direction A flatwise	8.2	4.2	6.7
	Direction A edgewise	5.9	2.7	3.8
	Right angles to A flatwise	6.6	3.0	4.2
	Right angles to A edgewise	3.9	2.0	2.9

Curing temperatures and times usual with phenol formaldehyde laminates are suitable; 145 degrees C. and 20 mins. for a finished thickness of ⅛ in. are recommended, but equally good results can be obtained at higher temperatures (170-180 degrees C.), with shorter curing times. Pressures from ¼ to 1 ton per sq. in. are normally used; excellent results are, however, obtainable by low-pressure methods, using pressures of 50 lb. per sq. in. and less.

Pre-curing of the felt is generally necessary. The amount of pre-cure depends upon the age of the material and varies from 2 hrs. at 80 degrees C. (for entirely fresh material) to a few minutes (for material three to four months old). No pressure is required during pre-curing. In the case of low-pressure moulding at 50 lb. per sq. in. or less, pre-curing is unnecessary.

Durestos, in uncured condition, remains soft for a considerable time.

As with all other high impact moulding materials, the flow properties are somewhat limited. Shapes involving a high degree of double curvature can be made if the material is cut to shape before moulding. Large differences in thickness or section present a problem which can be solved by adding local insertions, but which can often be avoided by designing the moulding to suit the characteristics of the material.

For press plates, polished monel metal, nickel, Inconel and planished blue steel all give excellent results. Chromium-plated steel is satisfactory, but there may be a tendency for the plating to strip away. Stainless steel and aluminium plates are not recommended. Normal mould lubricants, e.g., zinc stearate and oleic acid, are suitable.

Typical applications include mouldings for aircraft, such as fairings, tanks, covers, etc.; boxes and containers (e.g., for batteries); dipping pots, buckets and vats for chemical use. Canoes, dinghies, etc., can be made by low-pressure moulding technique.

In form of sheets and slabs the cured material has diverse structural and mechanical uses. In aircraft it may be used for fire-resisting bulkheads, or as bases for the mounting of mechanism, instruments, etc. Other uses include slot

(*Continued on page* 313)

Paper of High Wet Strength

By Dr. I. Bursztyn*

PAPER, used almost exclusively for writing purposes until about 70 years ago, had very low moisture resistance. The growing complexity of our modern life, however, compelled people to use paper to an ever increasing extent as packaging material, and it was soon found that although paper plays a role in holding numbers of small items together, and although it protects goods from dust, direct sunshine, etc., it does not protect goods from the direct or indirect action of moisture.

As soon as paper was introduced as wrapping material, numerous devices were sought to improve this inherent weakness.

The Institute of Paper Chemistry in Wisconsin, in 1943, published "Proofing of Paper." This book contains no less than 3,000 references to patents and methods of converting normal paper into a moisture-protective barrier. We are familiar with waxed paper and with paper treated with tar, bitumen, and emulsions of various kinds, all of them serving as barriers against moisture. Experience has shown that most of these materials, although giving protection for some time against wetting, have no permanent effect. As soon as the paper is wetted, it loses most of its strength and no longer plays the role of packaging material.

Early Attempts to Increase Wet Strength

It was found that it is necessary to do something to the paper in order to improve its mechanical strength in the wet state. Such paper, treated in one of the usual ways, could serve as a permanent moisture-protective barrier and, having both strength and impermeability to water, could serve as packaging; indeed, in many cases serve better than the more expensive wood, textiles, or other packaging materials.

The inherent weakness of paper is shared by a number of other materials. In the 1920's, rayon was just as weak as paper, when wet. The high degree of swelling of rayon in water was responsible for it. The high degree of swelling was also responsible for the ease with which rayons would crease. In order to reduce these weaknesses, a treatment was devised to improve the wet strength. This treatment was the first attempt to introduce synthetic resins into cellulosic materials without essentially changing the character of the treated material. In other words, rayon after treatment was still the same, but had important improvement in that it did not lose more than about 20 per cent. of its dry strength when wet.

It was obvious that this same method of impregnation could be used for increasing the wet strength of paper. However, it was soon found that the cost of treatment of a square metre of paper was the same as the cost of treatment of a square metre of rayon, and if the price of treated rayon was increased by about 10 per cent, the price of treated paper increased by about 200 per cent. This price increase for paper of high wet strength prejudiced any further development on these lines, and paper therefore had to wait for other developments.

The absolute necessity to develop a paper of high wet strength for the Far Eastern theatre of war, 1941-45, speeded research and development work in the United States and in Britain.

The purpose of the present article is to describe certain stages of research and development for producing resins, and, likewise ways and means of applying them for obtaining paper of high wet strength at costs as low as possible.

The method of imparting high wet

*Aero Research, Ltd., Duxford, Cambridge.

Table 1.—Test Results on Kraft Paper treated with 2% Aerolite 70 compared with Untreated Paper.

Strength	80 grams treated with rosin		80 grams treated with 2% Aerolite 70				80 grams treated with 2% Aerolite 70			
			Not matured		Matured		Not matured		Matured	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Grams/sq. metre ..	83	—	88.8	—	89.6	—	81.5	—	82.6	—
Breaking length machine	11,800	1,050	14,000	4,700	13,300	4,800	13,800	3,850	13,700	4,500
Wet strength % ..	—	8.9	—	33.6	—	36.1	—	27.9	—	32.9
Breaking length cross	5,650	640	6,150	1,810	6,000	2,500	5,850	1,720	5,900	2,650
Wet strength % ..	—	11.3	—	29.5	—	41.7	—	29.4	—	44.9
Average	8,725	845	10,125	3,250	9,650	3,650	9,825	2,785	9,800	3,575
Wet strength % ..	—	9.7	—	32.1	—	37.8	—	28.3	—	36.5
Stretch machine % ..	2.2	0.3	2.4	2.5	2.5	2.5	2.4	2.7	1.9	2.1
Stretch cross % ..	2.1	2.0	3.7	3.7	3.8	4.7	3.2	3.7	3.0	4.7
Mullen	71 lb. = 148%	0.8 lb. = 16.5%	92 lb. = 174%	41 lb. = 78%	89 lb. = 170%	42.5 lb. = 82%	86 lb. = 179%	35 lb. = 73%	83 lb. = 166%	36 lb. = 73%
Wet strength % ..	—	1.1	—	44.6	—	47.7	—	40.7	—	43.3
Tearing machine ..	128	85	118	224	129	228	107	172	109	182
Wet strength % ..	—	66	—	190	—	177	—	161	—	167
Tearing cross	134	88	129	278	125	278	118	182	111	192
Wet strength % ..	—	66	—	215	—	222	—	154	—	173
Folding machine ..	710	0	1,415	335	2,310	225	1,198	195	1,268	100
Wet strength % ..	—	0	—	23.7	—	9.7	—	16.3	—	7.9
Folding cross	170	0	370	45	294	59	1,760	20	900	10
Wet strength % ..	—	0	—	12.2	—	20.1	—	1.1	—	1.1
Air perm.	280	—	110	—	90	—	90	—	80	—
Water absorption ..	—	73	—	47	—	59	—	60	—	60

strength to rayon consisted in impregnating rayon with urea-formaldehyde precondensates and catalysts, drying the impregnated material, and curing it for about 15 minutes at a temperature of 130-140 degrees C. This costly method of obtaining high wet strength, however, could not be used for the treatment of paper for two reasons: (1) paper mills lacked heating equipment for the necessary curing; (2) costs were high.

Development of "Beater" Resins

The Brown Co., in the United States, gave the answer to the question of curing. In B.P. 502,425 (1939) they proposed an addition to the paper machine consisting of a cylinder heated to about 300 degrees C. The paper containing 1-5 per cent. of urea-formaldehyde resin and subjected for a short time to this very high temperature was claimed to instantaneously attain high wet strength.

For the Brown Co, the problem was solved from the point of view of curing, even of U.F. resin applied at a very early stage of their condensation. They could apply the liquid resin to the wet web of the paper, or they could have on their machine an intermediate impregnation stage after the paper had been partially dried. This method, however, could be used only for paper of relatively low weight, as heating of a thicker sheet would char the side in direct contact any length of time with a surface of temperature 300 degrees C. or higher.

The obvious step to take was to produce a resin of a higher degree of condensation, but at the same time infinitely dilutable in water, even at a low pH. Such resins were known, and Aerolite 350, made by Aero Research, Ltd., is a typical example. This type of resin could be applied in course of tub-sizing for papers which are usually tub-sized, or to the wet web of the paper on paper machine. The normal heat of the drying cylinders was sufficient to polymerize, condense and harden the resin, so that

paper coming from the drying cylinders had an appreciable degree of wet strength.

This war-time solution was a definite step in the direction of making paper of high wet strength, while avoiding curing processes.

There was still the problem of finding a resin which could be introduced at a stage earlier than the paper machine, i.e., a resin which, added to the pulp, would ensure an absolutely even dispersion within the fibres. It was likewise a question of finding some resin which would, from an application point of view, behave like rosin, size or colour, or like any of the usual paper-making chemicals which are added to the beater or to the chest.

The first theoretical considerations led us to believe that a highly reacted resin of high molecular weight would fulfil the conditions of sizing. The characteristics of such a highly condensed resin were:—

(1) Minimum of heat and not too low pH necessary to set such a resin.

(2) Not normally water soluble, making it possible to obtain very high retention in the treated paper.

On the other hand, such resins have a very limited storage life, and recent patents[1] propose the use of other materials in conjunction with such resins in order to improve their shelf life. Investigations on these resins, however, have shown that it is not necessarily true that a highly reacted resin which has a limited solubility in water and therefore shows a high retention in the paper gives the best wet strength properties.

It was therefore desirable to find methods which, while allowing to make a highly condensed resin, would, at the same time, impart water solubility Resinous Products and Chemical Co.[2] propose to introduce salts of H_2SO_3, or to sulphonate the resin in order to make it water soluble, while, at the same time, reacting it to a high degree of condensation.

A further point readily found out was that, although some resins, like melamine formaldehyde, when prepared in a certain way, work equally well with bleached and unbleached "furnish," urea-formaldehyde resins work far better with unbleached than with bleached furnishes. Investigations by Aero Research, Ltd., were centred on urea-formaldehyde resins, as we thought that the ultimate price of the resin to the papermaker would be of vital importance, keeping in mind the usually lower price of paper compared to other materials (textiles, etc.) weight for weight.

We arrived ultimately at a point where resins fulfilling the requirements of papermakers were produced, and then set out to test their performance on various furnishes. By varying the conditions of the preparation of the resins, and also the conditions of application, we were able to define the optimum under which "beater" resins could be prepared and applied to papermaking.

Experimental

Throughout our experimental work we used Swedish Kraft and Swedish sulphite pulp. The beater was an experimental American "Valley" machine. We worked with a consistency of 2 per cent., using in every charge 280 grams of air-dry fibre. For sheet making, the British Pulp Evaluation machine was used. The degree of beating was tested by "drainage time," i.e., the time necessary for draining a full cylinder of water containing 1 gram of "furnish," and throughout

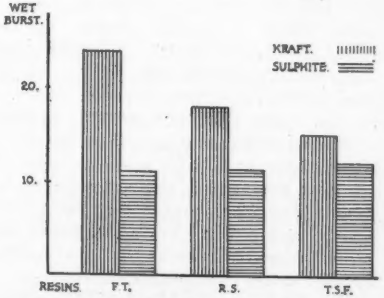


Fig. 1.—Performance of three resins, 2% resin pH 5, curing time 3 mins. at 110°C.

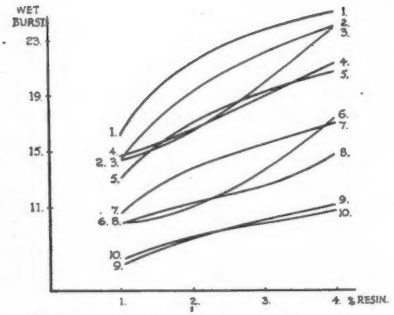


Fig. 2.—Effect of added amount of resin.

(1) F.T. Kraft.
(2) R.S. Kraft.
(3) T.O.S. Kraft.
(4) N.O.R.S. Kraft.
(5) N.O. Kraft.
(6) T.O.S. sulphite.
(7) F.T. sulphite.
(8) R.S. sulphite.
(9) N.O.R.S. sulphite.
(10) N.O. sulphite.

our experiments this drainage time was 20 secs. The resin was diluted with warm water and added to the disintegrator. Alum was added after the addition of resin. As our tap water had a pH of 7.8-8, adjustment was necessary to pH 5 by adding sulphuric acid (2N) to the cylinder, the necessary amount being about 15 c.c.

After the sheets were air-dried over night at a temperature of about 18 degrees C., they were cured on a steam-heated copper surface, conditioned and tested for weight and dry and wet burst. The "wet burst" was taken after the sheet was submerged for 24 hours in water.

The resins we have been using were U.F. of ratios varying from 1:1.75 to 1.2. The resins marked "N.O.," "T.S.F." and "N.O.R.S." were low-ratio resins with a low water solubility; those marked "R.S.," "T.O.S." and "F.T." were resins of a higher ratio (though highly reacted) and of good solubility in water.

Fig. 1 shows the performance of three resins of decreasing solubility in water. It will be seen that for a given degree of reaction the resins of the best solubility in water give the highest "wet burst" on unbleached Kraft. For unbleached sulphite the burst is the same for all resins applied under like conditions.

Fig. 2 shows the effect of the added amount of resin.

Fig. 3 gives the relationship between time of curing and pH. It shows clearly that, in order to obtain wet strength within a reasonable time of curing, it is absolutely essential to have a pH not higher than 5.

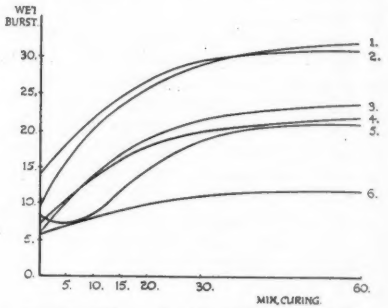


Fig. 3.—Effect of pH, 2% resin added, temp. 100°C.

(1) R.S. resin pH 5.
(2) F.T. resin pH 5.
(3) T.S.F. resin pH 5.
(4) R.S. resin pH 6.
(5) F.T. resin pH 6.
(6) T.S.F. resin pH 6.

Fig. 4 shows the degree of retention of resin as found by the Kjehldal estimation of nitrogen in the paper.

The comparison of Fig. 4 with Fig. 2, where the respective performances of the resins are given, shows that although the least-soluble resins give the highest retention in the paper, they do not impart the highest wet strength. It shows fur-

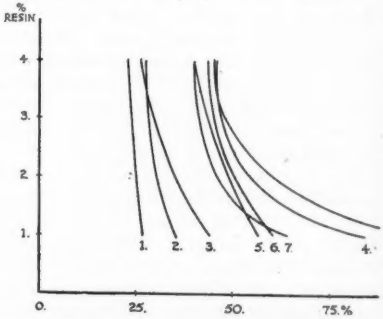


Fig. 4.—Resin retained in paper.

(1) F.T. resin to sulphite.
(2) N.O. resin to sulphite.
(3) T.O.S. resin to sulphite.
(4) N.O.H.S. resin to sulphite.
(5) F.T. resin to Kraft.
(6) N.O.R.S. resin to Kraft.
(7) T.O.S. resin to Kraft.
(8) N.O. resin to Kraft.

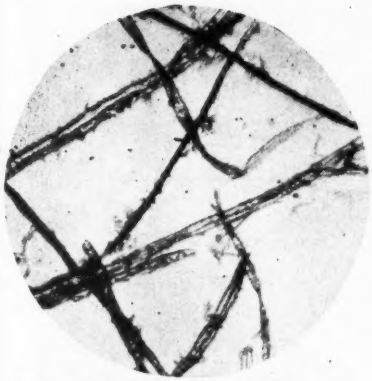


Fig. 5.—Photomicrograph showing deposition of water-soluble resin along the fibre.

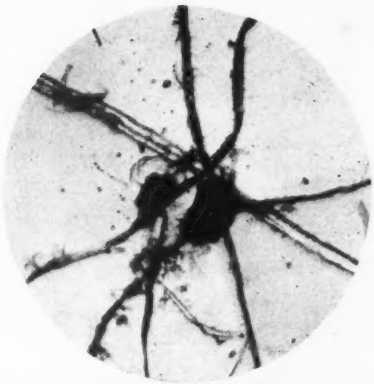


Fig. 6.—Water-insoluble resin seen as very large particle.

ther that the more resin is added, the less is relatively retained. It leads to the conclusion that the optimum addition of resin for both retention and strength yielded is in the region of 2 per cent. for resins of low solubility, and even less than 2 per cent. for resins of high solubility.

In order to find why highly reacted resins of a high molecular weight show a poor performance, photomicrographs were taken of the treated paper. The treated paper was stained with a 1 per cent. solution of the acid dyestuff Alizarin Saphirol BS and washed for an hour under running water. The water washed away almost quantitatively the dyestuff from the cellulose, but the resin remained stained. Fig. 5 shows the deposition of the water-soluble resin along the fibre. Fig. 6 shows the water-insoluble resin in the form of a very large particle or chunk.

Figs. 2 and 4, in conjunction with the photomicrographs (Figs. 5 and 6), lead us to believe that the degree of retention of a resin by paper does not necessarily mean that the paper will have a high wet strength. The chunk of resin holding several fibres together (Fig. 6) gives certainly a very strong bond which is quite waterproof. However, the distribution of this kind of resin, due to its insolubility in water, is not regular, and one has a very strong bond between some fibres and very weak bonds between other fibres. The paper will break down on its weakest points; it will therefore have an all-over low wet strength.

By adding large amounts of resin it is obviously possible to secure even bonds everywhere in the paper. However, we should then have to deal with a substance which has lost its paper characteristics; it will be a plastic sheet of high dry and wet strength, but not paper.

Fig. 3 shows that the longer a resin-treated paper is cured, the better its "wet burst." It is obvious that, under practical conditions of papermaking, it would be impossible to heat the paper for longer than one minute. What happens to the paper after a short curing time?

Fig. 7 shows the effect of maturing. The paper containing 2 per cent. resin and cured for one minute at 110 degrees C. was tested for wet strength over a period of 98 days. The curves show the

Table 2.

Resin 70 added (per cent.)	Dry breaking length (m.)	Wet breaking length (m.)	Wet/Dry (per cent.)	Retention of resin in paper (per cent.)
0	6,100	520	8.5	—
1	6,340	2,120	33.5	65
2	6,900	2,700	39.2	46
4	7,050	3,000	42.5	40

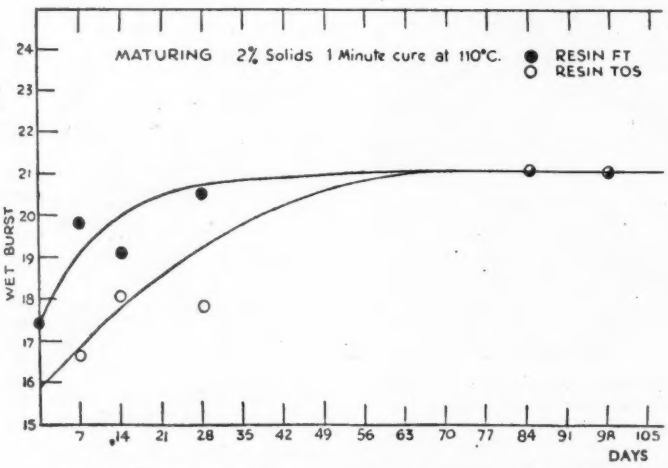


Fig. 7.—Effect of maturing paper treated with water-soluble resin.

effect of maturing paper treated with water-soluble resins; after one month's maturing, the paper has reached stability.

The results of our laboratory experiments called for a confirmation on large-scale production runs. Table 1 shows the results obtained on a large-scale run with unbleached Kraft on an M.G. machine in Sweden. It comprises tests on untreated and treated paper under otherwise same conditions.

Table 2 gives the average of production runs in various mills in Britain, the furnish here consisting of some waste Kraft, in addition to virgin pulp.

Uses of Paper of Improved Wet Strength

A list of types of papers where wet strength is of importance was given in an American source (F. A. Strovink, "The Practical Application of Melamine Resin in Paper"), and includes abrasive papers, advertising posters, bag papers, box and barrel liners, cigarette paper, food wrappings, etc.

Treatment of "Broke"

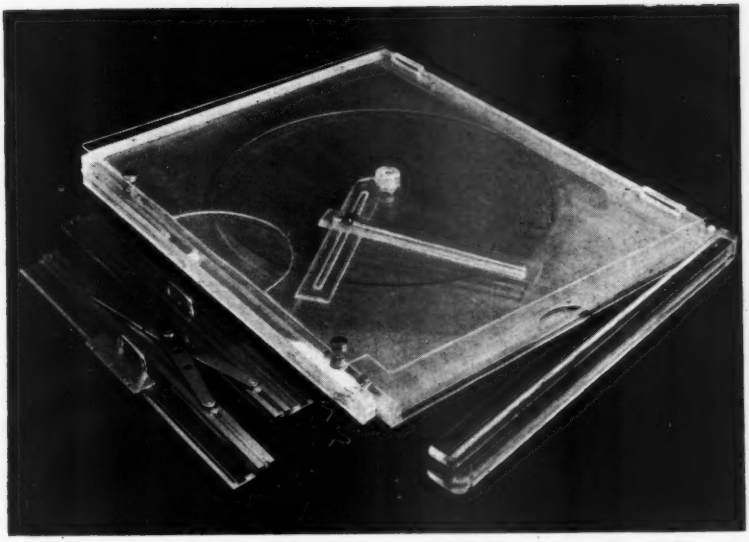
It is of utmost importance to the paper manufacturer to re-use waste, yet it is obvious that paper of increased wet strength will not repulp easily.

The wet strength of paper treated with U.F. resin, freshly off the machine, has rarely a higher wet/dry ratio than about 20 per cent. Such paper presents no difficulty in repulping in the ordinary way. A well-matured paper can have a wet/dry ratio of about 50-70 per cent. and then it can present serious trouble to the papermaker.[4] U.F. resins, as distinct from M.F. resins, generally speaking, are not boilproof; they also hydrolize at a low or high pH. It is now a generally accepted method of repulping by beating warm at a pH of about 4.

More serious difficulties confront a paper treated with M.F. resins, but even here it is possible to get rid of the "broke," particularly so as most "white" mills have some sort of pressure-cooking arrangements.

REFERENCES

(1) *Wiggins Teape and Co., Ltd., B.P.* 582,157 *and* 582,235. **(2)** *Resinous Products and Chemical Co., B.P. Appli.* 23,128, *Nov.* 21, 1944. *Open to Public Inspection.* **(3)** *C. S. Maxwell, P. Trade J.*, 1943, **116**, 39. **(4)** *I. Bursztyn, Finnish Paper and Timber J.*, 1946, *No.* 15.



Plastics Aids to Navigation

THE exacting requirements of modern navigation are being met by two new instruments, for which the advantages of transparent plastics offer a convenient material of construction.

The navigrid is designed especially for use in small craft that have no separate room for navigational facilities. The watertight case, with its compartments for spare charts, wax pencil and cleaning pad, and the compass and double-hinged rule, are all made in transparent plastics, the chart while in use never being touched.

By means of this instrument all pilotage problems can be solved, the plotting being done on an outside cover. Parallel drawing to the red north-south compass arrow is a simplification that will be appreciated by every navigator.

The parallel rule, which is seen to the left of the navigrid in the accompanying illustration, supersedes the roller and the linked types now used. It is made in transparent plastic and stainless steel. The simple cross-piece, fitted to slides which travel in tracks, gives vertical, horizontal and circular motion, with a range of accurate chart coverage which no other rule of the same size attains.

A detachable course and bearing corrector is also fitted, this sliding in a third track. The corrector converts "true courses" or bearings to magnetic and compass equivalents and vice versa, allowing them to be plotted on the chart without reference to the compass rose—a development with many uses.

The prototype models of both instruments were made by J. Starkie Gardner, Ltd., Southfields, London, S.W.18, to the patented design of Commander W. B. Luard, O.B.E., R.N.

ANGLO-BELGIAN EXHIBITION.—An exhibition will be held this year in the Salle de la Madeleine, Rue Duquesnoy, Brussels, September 4 to 9 inclusive, to show the products of British manufacturers to buyers for the European markets. It is being organized by H. and H. Trading (London), Ltd., 5, Copthall Buildings, Copthall Avenue, London, E.C.2.

World's Industry Employs Plastics

GENERAL ENGINEERING

Abrasive finishing of plastics is subject of new data sheet giving the characteristics of the abrasive and the grinding wheel to be used. Apart from aluminium oxide, silicon carbide and softer abrasives, it refers to the usefulness of metal-bonded diamond wheels in the grinding of bullet-resistant glass for war purposes. (" Materials and Methods," 1947/March/119.)

Glass fibres, first introduced ten years ago, have fulfilled the expectation for a fairly strong, highly notch sensitive, non-metallic material of low but almost entirely elastic deformability. (" Materials and Methods," 1947/March/82.)

Spiral bevel gear enclosed in solid transparent Plexiglas is used as demonstration model. The operation of the gears may be closely observed. (" Mill and Factory," 1947/March/316.)

Lightweight electric power tool has a two-part housing moulded of Tenite assembled over a die-cast aluminium frame enclosing the motor. (" Machine Tool Blue Book," 1947/**43**/359.)

Rivets made of Plexiglas are formed without blow by simply heating and expanding them. They provide a strong and rigid bond, and also have decorative effect. Solid as well as hollow shank rivets can be made. (" Scientific American," 1947/April/176.)

High-speed plastic bearings are reported upon by C. M. v. Meysenbug. (" Kunststoffe," 1946/**36**/5.) Based on experience in testing on a test stand, items characterizing these bearings include change of temperature over running time, course of friction and temperature in relation to load, and position of minimum friction.

Photo-elastic stress is measurable on transparent, normally-isotropic substances which become doubly refracting when stressed. Among most suitable materials is Bakelite BT-61-893. Data on preparation and machining obtained in the Kolling Laboratories are given by W. H. H. Gibson. (" Symposium on Failure of Metals by Fatigue," University of Melbourne, Dec., 1946.)

Sandwich materials have been discussed in " Machine Design " (1947/Mar./144). H. B. Gibbons deals with production and use of metal-faced Balsa-wood-core material; J. F. Korsberg, with design features.

Laminated plastics, their production and their importance for industry, are subject of illustrated article in " Techn. Rundschau " (1947/March 28/4.)

Flexible glass (glass impregnated fabric) have hitherto caused difficulties in cutting; this problem has now been solved by using a Carbololoy 905-tipped saw fitted to a hand-guided power saw with a peripheral speed of 21 ft./min. The life of the saw was 90 days without regrinding, during which time about 60 high-speed steel saws would have been consumed. (" Scientific American," 1947/March/135.)

Plastic-bonded plywoods are taking their place alongside conventional structural materials, which they often surpass in strength, durability and beauty. (" Scientific American," 1947/Mar./113.) Statistical figures about the consumption of different types of glues are given, which show that 45 per cent. of softwood plywood is made with synthetic resin; about 41 per cent. of hardwood plywood is made.

Assembly of plastics components by cementing and mechanical means is reviewed in a booklet (PE-5) published by Society of the Plastics Industry, New York.

Surface of thermoplastics is affected by heat in manner similar to a solvent or a cement; if pressure is applied to a heated seam, bonding results. The details of this technique have been discussed by W. D. Wenger (paper presented to Society of the Plastics Industry, New York, abstracted in "Product Engineering," 1947/March/130).

Glass fibre reinforced plastics are surveyed in "Product Engineering," 1947/March/160. Diagrams and tables show that these new materials compare very well in tensile strength with known engineering materials; the differences are still more pronounced when tensile strength is divided by specific gravity.

Deformability of thermosetting plastics after "hardening" is tested by simple adaptation of the Schopper Pendulum device. The moulding is subjected to this test directly when coming from the press. In the test the sample, for instance, a beaker, is subjected to a constant static pressure. ("Kunststoffe," 1946/**36**/49.)

MISCELLANEOUS

Soft hammer with faces made of nylon, weighing 2 lb., is produced by Danielson Mfg. Co., Danielson, Conn. The replaceable nylon faces do not chip or mushroom; the nylon also resists fire, chemicals and oils. ("Machinist," 1947/**90**/2104.)

Natural science preparations for demonstration purposes utilize vinylite resins. The resin is injected into the circulatory, respiratory and excretory system, such as lungs, liver and kidneys. The technique necessary in making these preparations are described and illustrated. ("Ward's Natural Science Bulletin," 1947/March/51.)

Crystal-clear plastics are finding more attention for embedding biological specimens. The advantages are elimination of danger of breaking and convenience in handling. Various new preparations for this purpose are announced. ("Ward's National Science Bulletin," 1947/March/50.)

Mexican plastics industry has a tentative production capacity for 1947 of 1.2 million dollars. ("Chemical Age," 1947/April 26/537.)

New compounding system for batches from 40 (laboratory) to 1,000 lb., developed by Hungerford Plastics Co., may enable moulders to compound their own materials in a single operation. The moulding process for cellulose acetate is described. ("Scientific American," 1947/April/162.)

Safety panorama goggle of American Optical Co., Southbridge, Mass., is equipped with plastic lenses and said to protect the eyes against particles striking from any direction. The frame is also of plastic. ("Machine Tool Blue Book," 1947/April/343.)

Polyvinyl resin tubing by Resistoflex Corporation, Belleville, N.J., has satisfactorily solved the problem of flexible hose assembly for connecting the work-clamping arrangement of the machine table of multiple-boring woodworking machines with main hydraulic system at the base. ("Machine Tool Blue Book," 1947/April/350.)

New creaser form 90 degrees creases or folds with repetition uniformity of 5 to 20 per cent. thermoplastic sheeting up to 30 ins. width. It is used in making square set-up boxes and other transparent novelties requiring right-angle creasing. ("Mill and Factory," 1947/March/180.)

Plastic settings are being used for fixing synthetic sapphire to metal. Investigations have been made with four thermosetting, five thermoplastic and two cold-setting cements. ("Machinist," 1947/Jan. 4/1607.)

Decoration of transparent plastics is approached from new angle by sand-blasting them from the underside, using stencils, and aiding effects by colouring. ("Scientific American," 1947/**176**/163.)

Plastic-coated mesh, Vimlite, developed during the war, is now in peace-time use for lampshades, luggage coverings, etc. It may prove useful in vibrating machinery, where the use of glass is excluded. ("Scientific American," 1947/**176**/163.)

Double injection process produces permanently visible letters and numeral keys of "Tenite" for a new electric adding machine. At first the plastic forming the letter is injected, followed in the second stage by the surrounding material. ("Machinery" (N.Y.), 1947/March/185.)

Transfer moulding shows to advantage in production of components with a large number of inserts, or inserts of a slender nature, primarily because inserts can be more readily supported, and material is injected into cavity in plasticized state. ("Machinist," 1947/**90**/1909.)

Radio receivers, produced at the rate of one every 20 secs., according to method of John A. Sargrove, is made possible by new plastic design, metallizing process and electronically controlled machine units. Diamond-equipped milling cutters are employed for removing metal from places where not required. ("Machinist," 1947/Mar. 29/1987.)

Centrifugal casting of plastics has possibility of removing air bubbles from phenolic resins, even when pigmented and with filler. ("Machinist," 1947/Mar. 29/2006.)

Strippable plastic compound, "Spray-Peel" (Coronel Industries, Los Angeles, California), is applied by brush or spraying, and dries quickly to a rubbery film. ("Products Finishing," 1947/March/112.)

Protective coating, "Phenoglaze," a phenol-formaldehyde preparation, is impervious to heat, moisture and chemical action; it is applied by spray, brush or dip methods. ("Products Finishing," 1947/March/113.)

Plastic replicas of surface to be inspected are optically magnified and viewed by transparent light. A dual projector for this Faxfilm method has been developed whereby a standard surface replica may be viewed side by side with the replicas of actual samples. ("Products Finishing," 1947/March/120.)

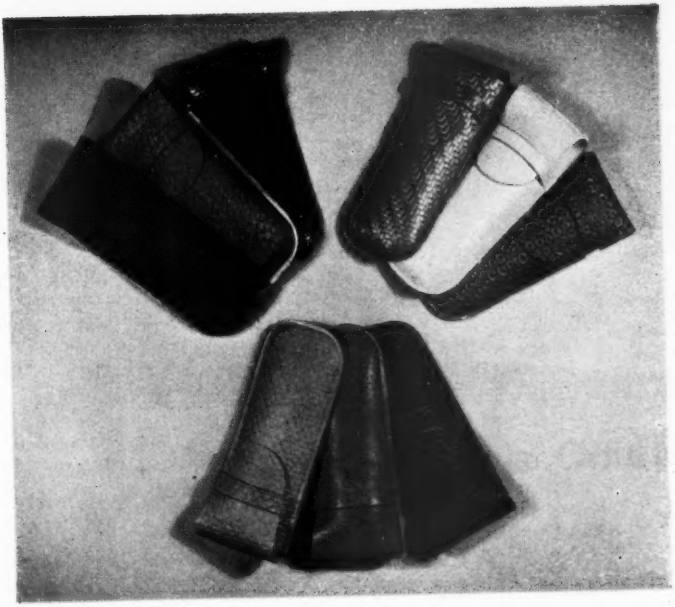
Heat-sealing equipment incorporates press pad made with silicones. The pad withstands continued exposure at 300 to 350 degrees F., with no noticeable change in flexibility or surface hardness; it will not adhere to plastics, glass, cloth, metal and other packaging materials. ("Production Engineering and Management." 1947/April/87.)

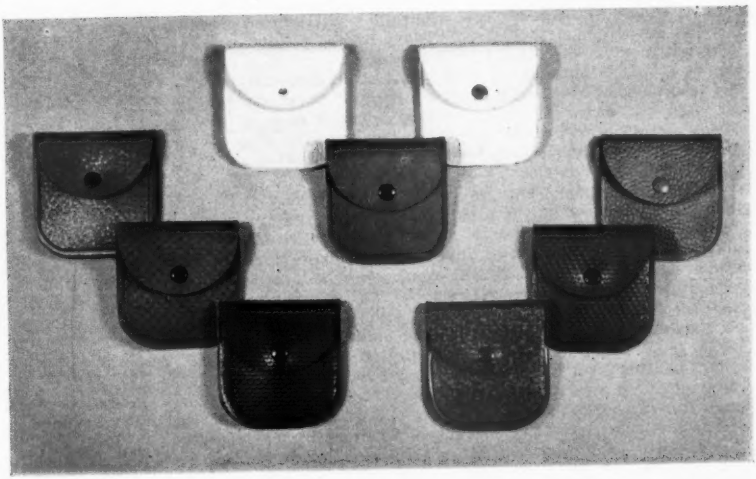
Protection of workers against acids, alkalis, grease, oils, etc., is afforded by "Durma-Gard" apron of polyvinyl chloride-acetate. This apron weighs only 10 oz. and is washable with soap and water. ("Autom. and Aviation Industr.," 1947/Mar. 1/47.)

Component sections of Kelvinator refrigerator, 31 ins. long, are produced in white polystyrene, using a 16-oz. H.P.M. injection moulding machine and maintaining a 70-second cycle. ("Production Engineering and Management," 1947/March/95.)

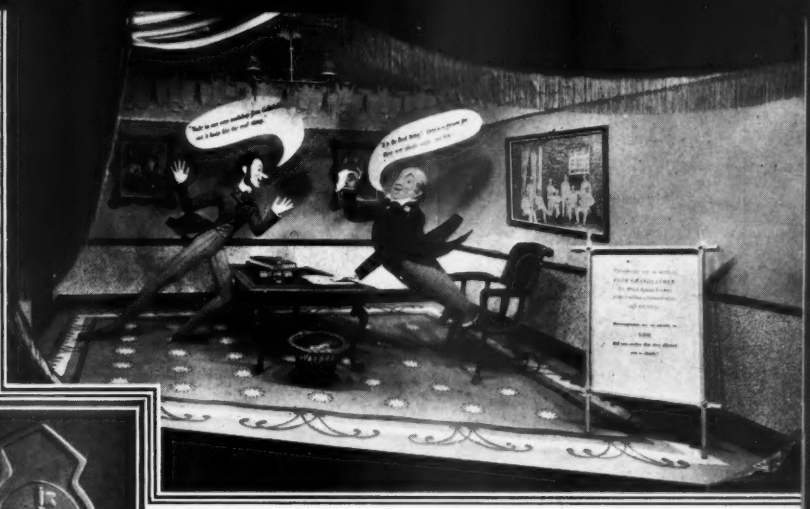
SOURCES OF REFERENCE.

We wish to remind readers that the sources of reference from which these pages are compiled are not, in general, retained in this office. We cannot, therefore, undertake to supply such originals. Nevertheless, most of the foreign journals referred to are available in the Patent Office Library (Southampton Buildings, Chancery Lane, W.C.2) and in the Science Library (South Kensington). Photo-duplicated copies of articles may be obtained from the Photostat Dept. of the Patent Office.





Specimens of unique production in British plastics manufacture. Both spectacle cases and purses are of stout polyvinyl chloride sheet (over $\frac{1}{16}$-inch thick) embossed with various surface designs. Seams have been welded by the high-frequency process to give great strength and long life. D. & D. Plastics Ltd. are the manufacturers; materials supplied by Erinoid Ltd., Vinyl Products Ltd., and others.



(Top) British Xylonite Group celebrate the discovery of Celluloid and the Celluloid Collar.

(Below) Lovely paper knife in "urea," by Insulators, Ltd., to celebrate B.I.F., 1947.

Plastics at Earls Court

THE notes and pictures published in the May issue of "Plastics" were but pre-Fair views—the bare bones of what we now see as a fully clothed and living entity in the pages that follow here.

The photographs of the stands, each a mirror of the individual factories they represent, are in a very strong sense historical documents, showing the present stature of the industry, and when compared with those we published in far-off pre-war days show a rate of growth attained by no other industry.

It is, indeed, a welcome thing to note the entry of the artist-designer in the structure of most of the stands. This is of great importance, and in quality there have been great strides. But of far greater value is the manner in which the individual factories have widened and expanded their productions, whether it be in the number of different raw materials or the dazzling variety of finished goods.

The number of exhibitors was very much greater than at any pre-war exhibit, as is natural, and we were particularly pleased to see the "great old ones" in force. Of outstanding interest was one display, if we can make an invidious exception for once, that in the large British Xylonite-Halex-BX Plastics group. The British Xylonite Co.—the oldest plastics concern in the country—chose an amusing illustration of the early discovery of celluloid as the motif for one of its panels. It is shown at the head of this page.

We were delighted to see, too, some of the "great old ones," such as Fraser and Glass, Ltd., who, we believe, never previously exhibited, and that "middle-aged" company, British Artid, that startled us in 1937 with the brilliancy of a new mould-making technique.

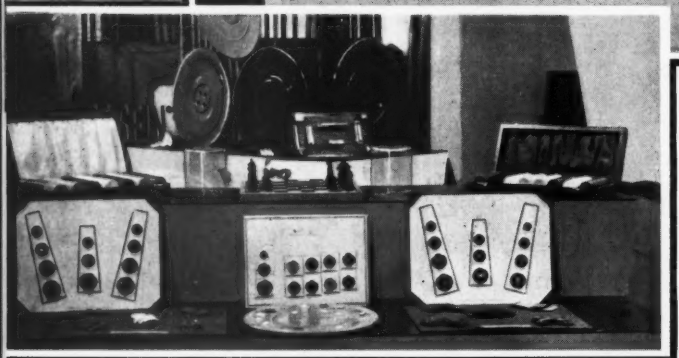
In 1937 we do not believe there were any exhibits other than by normal pressure moulding concerns, that is, in addition to raw material makers. Fully fledged extruding, calendering, fabricating and shaping concerns have now appeared in full force to add more colour and more variety to an ever-changing scene.

(Top) Part of I.C.I. stand showing Welvic, Crinothene, Alkathene and Nylon brushes and other monofil displays. In another section was displayed the use of Transpex for producing television lenses.

(Above and right) British Resin Products, Ltd., varied display of phenolic resins for moulding and adhesion, p.v.c. and allied compounds, and cellulose acetate moulding powders and finished products made therefrom.

(Above and right) Celastoid, the cellulose acetate sheet made by British Celanese Ltd., is the raw material for hundreds of different objects seen here. Of special note is the decorative fire-screen, "music-box," and lampshade with ostrich feather.

(Left) This journal displays its wares and serves as an interpreter for the industry.

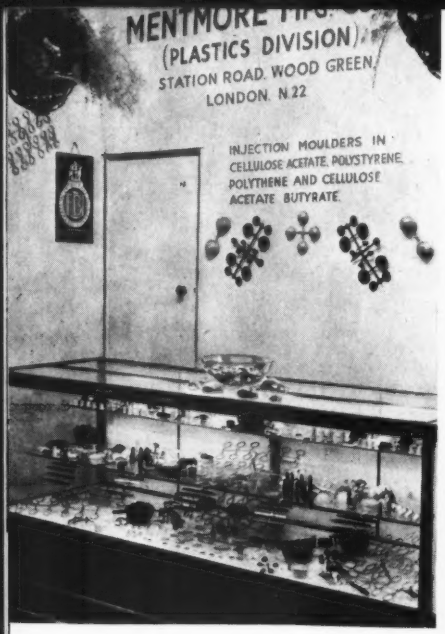


(Above and left)
Erinoid Ltd., with a remarkable display of outsize buttons and combs, so that all who run might see. Cellulose acetate, p.v.c. in decorated and leather-like form, polystyrene and cast resins were also on view.

(Right)
Lacrinoid Ltd. specialize in a host of varieties of buttons and handles for every conceivable purpose.

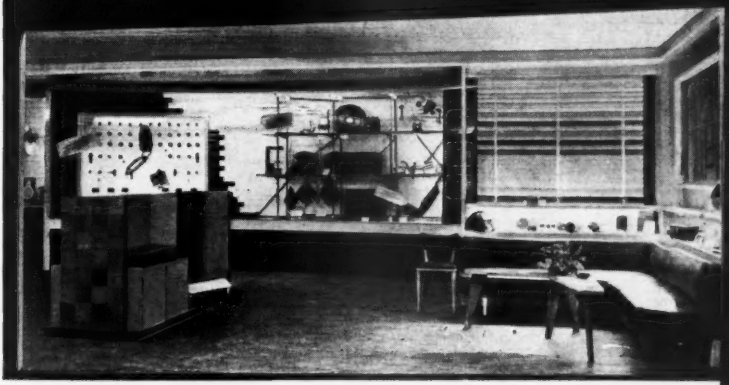
(Above and right) The B.I.P. group displayed a big range of "urea" resin mouldings, including buttons, radio-cabinets, clocks and kitchen ware. Cements and glues as applied to airscrews, cart-shafts, and tennis rackets, were a special feature.

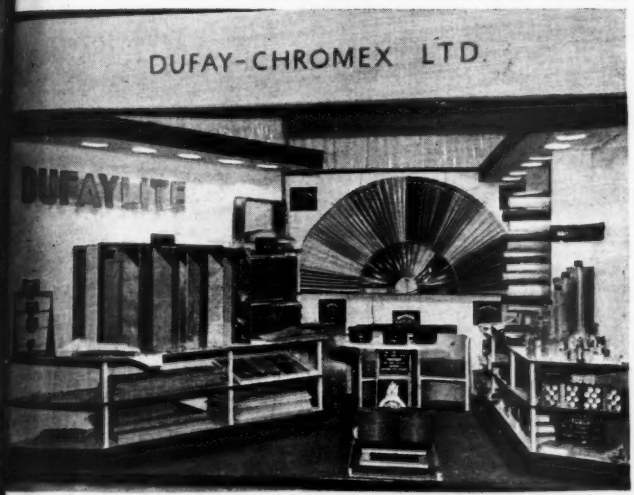
(Left) Holoplast Ltd., erected an entire chemical laboratory made of "Holoplast," the new laminated structural material.



(Left) Mentmore Mfg. Co., Ltd.: Famous for pens, this concern now specializes in all forms of injection mouldings.

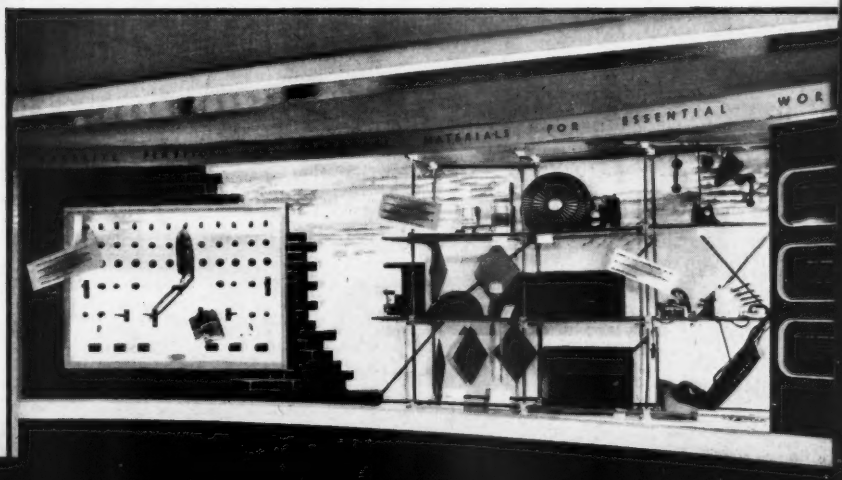
(Right and below) BX. Plastics, Ltd.: Lounge upholstery in white BX. p.v.c. with cherry piping; standard lamp shade in Bexoid and table lamp shade in ethyl cellulose. Below are seen some other BX. products.





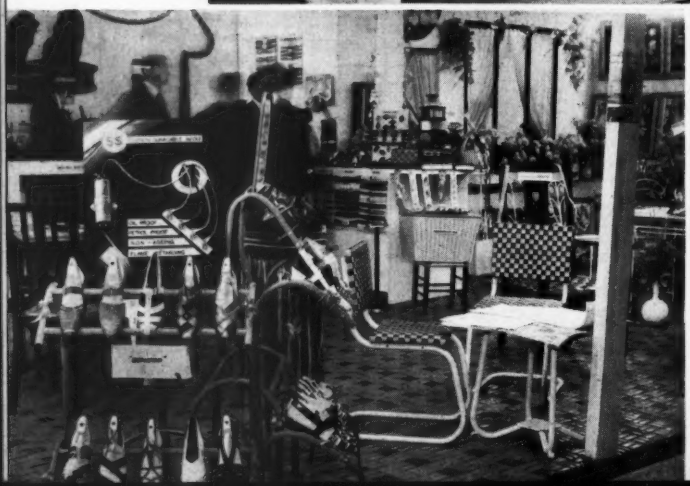
(Above and below) Bakelite Ltd. deal in broad terms with the use of Bakelite resins in various industries, including engineering, transport and housing.

(Left) The new honeycomb structure termed "Dufaylite" is strong and extremely light. British Turbophane Ltd. products made from thin cellulose sheeting were also seen here.

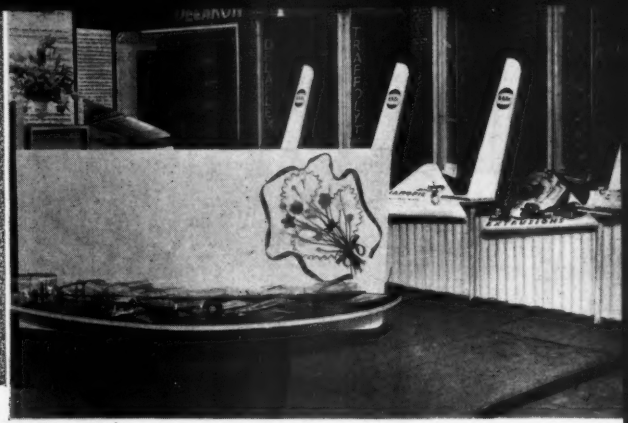


(Left) British Moulded Plastics Ltd. (formerly De La Rue Plastics): Radio cabinets, motor car facias, air-conditioning and electrical plant were the chief exhibits.

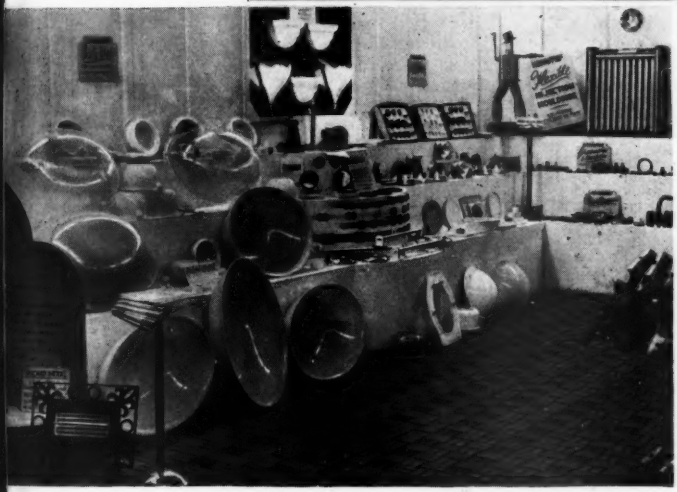
(Right) Vinyl Products Ltd.: Almost everything in "vinyl" compounds, as sheets, solutions and emulsions, the latter as adhesives, paper and textile treatment, etc.



(Left) Duratube and Wire Ltd.: Extruded p.v.c. in all forms, for wire covering, belts, shoes, bags, etc.



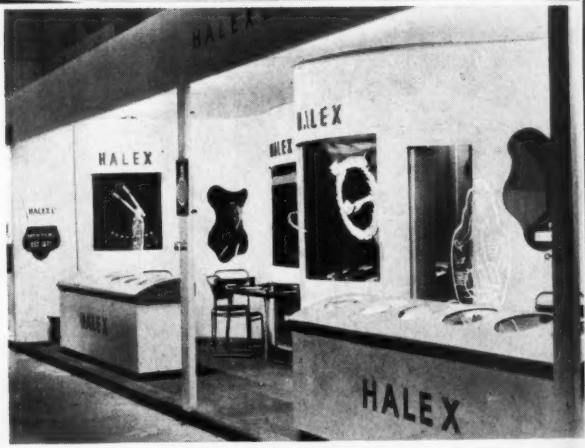
(Right) De La Rue Insulations, Ltd.: Laminated sheets decorated in colours and plain were the main exhibits here. In addition extrusions were on view.



(Left) J. F. Kenure, Ltd., allied to Duratube and Wire, Ltd., specialize in fabricated thermoplastics and flexible injection mouldings.

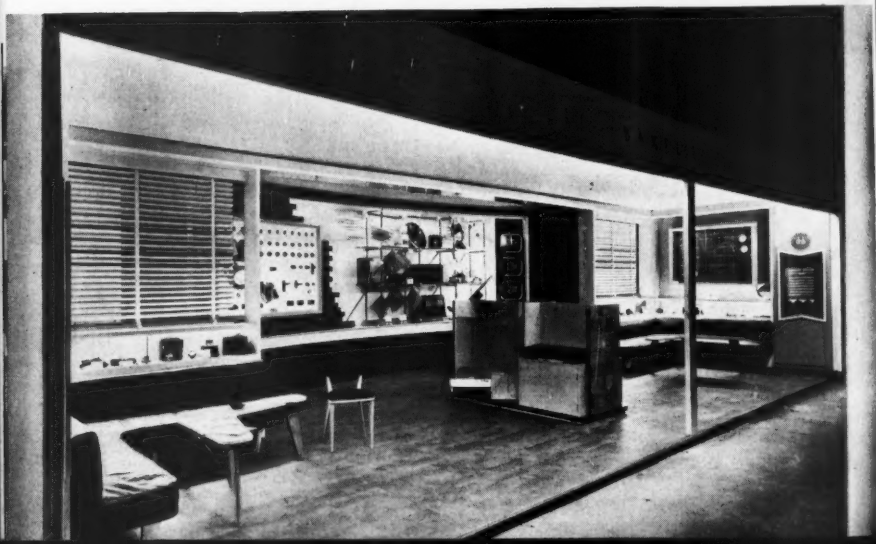
(Right) Fraser and Glass Ltd.: One of the clearest designed of stands, signifying precision mouldings issuing on "belt" from moulding press.

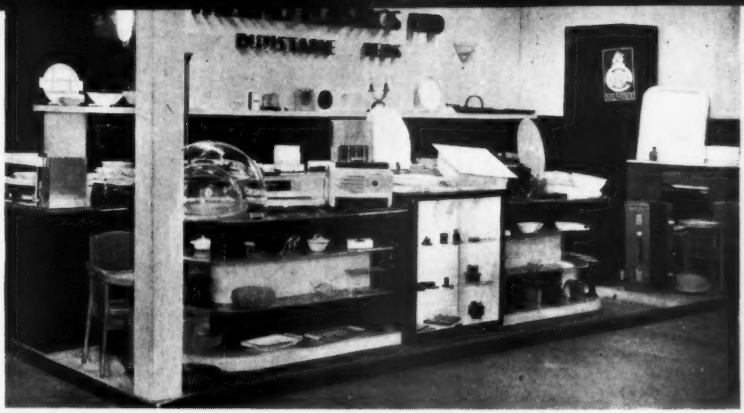
(Above) E.M.I. Factories Ltd., exhibited a wide range of radio-frequency dielectric preheaters of moulding powders.

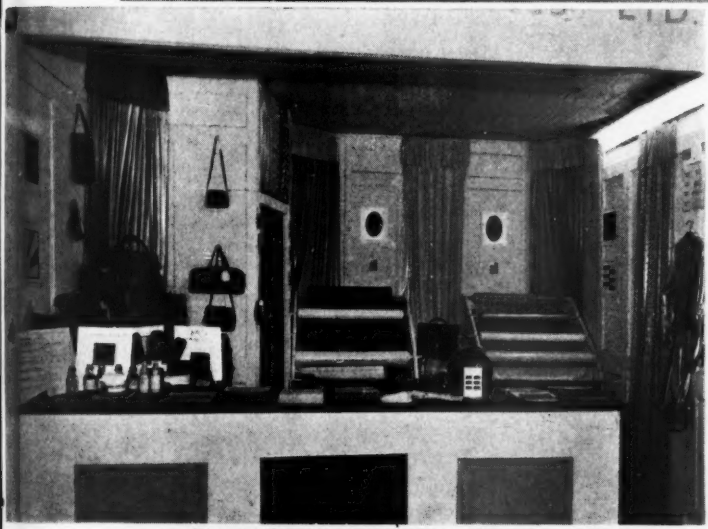


(Right) Halex Ltd. (British Xylonite Group), displayed brushes, combs, table tennis balls, condiment sets, etc.

(Below) Another view of the stand of Bakelite Ltd., giving a comprehensive view of finished goods, in electrical, heavy engineering, transport and housing, made from Bakelite.







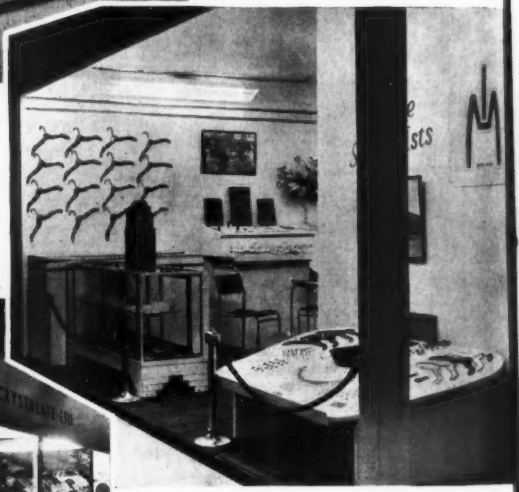
(Above) Thermo-Plastics Ltd.: Everything in fabricated and shaped thermoplastics, and suitcases and other specialities in post-formed phenolic sheet.

(Left) B. Lipman (Plastics) Ltd., exhibited printed and plain p.v.c. sheet for curtains, raincoats and upholstery.

(Below) Case Development Co. specialize in compression and other steel moulds, and also plastic mouldings.

(Right) Wokingham Plastics, Ltd.: Fabrication of fancy and similar goods from transparent and opaque plastic sheet.

(Left) Expanded Rubber Co., Ltd.: Unique in the production of cellular plastics for insulation and special units designed for strength and lightness.



(Right) Injection Moulders, Ltd.: One of the foremost of companies specializing only in injection moulding. A brave show was made of their new clothes-hanger and ladies' handbags, the latter made from injection-moulded units.

(Left) Crystalate Ltd.: While moulding almost everything, this concern specializes in high precision work for the electrical and engineering industries.

Infra-Red Heating in Shaping Methyl Methacrylate Sheet

Infra-red heating, especially with special electric lamp systems, has established itself as of fairly universal application for the drying, baking and curing of organic coatings. All modern installations for dealing with paint and enamel coatings on metal work give first consideration to this type of equipment. Thermal efficiency, simplicity and flexibility of equipment, cleanliness, ease of maintenance, and speed of production are its attributes.

INFRA-RED heating is not new; it represents the skilful use of a form of thermal energy. It has been investigated in many plastics problems, apart from the drying and polymerizing of coatings, and has been adopted successfully in specific instances. It is stressed that it is not necessarily useful in all cases, and cannot be employed indiscriminately. Thus, in the continuous moulding of thermosetting plastics, it could not efficiently substitute dielectric heating at radio frequencies. The latter heats by the thermal equivalent of the power losses in the material, heats uniformly and without losses. On the other hand, in the forming and shaping of sheet, especially thermoplastic-sheet material, it has possibilities.

Many ingenious means and devices have been resorted to in the shaping to accurate dimensions of expensive materials, such as the transparent acrylates. For large, flat sheets, heating has been achieved using banks of infra-red lamps uniformly arranged in a plane parallel to the sheet. Transparency of the latter has been counteracted by backing it with a sheet of polished aluminium, preferably "Alzak" anodized, and losses from the metal counteracted by a layer of insulating material, such as asbestos composition, behind it in turn. Even so, some of the large methyl methacrylate components, such as the "blisters" seen on aircraft, spontaneously arouse admiration at the skill that must have been entailed in the perfection of their fabrication. The large, spherical-shaped Perspex component moulded by the Triplex Safety Glass Co., and illustrated in the advertisement of Imperial Chemical Industries on the cover of "Plastics" (January, 1946), is sufficient illustration of this point.

The close research effort on the heating of methyl methacrylate sheet for shaping is revealed by British Patent 569,340. This patent shows an appreciation of the problem of bending and, in effect, drawing thermoplastics, and aims at ensuring that the heat is applied where, and in the quantity, it is required. Technically, this patent contains much practical information. In view of the present widening possibilities of using methyl methacrylate and other thermoplastic materials in sheet form, it is desirable that the subject of the patent specification be abstracted at some length.

Brit. Pat. 569,340, of Imperial Chemical Industries, Ltd., 1945, relates to the shaping of thermoplastic sheets. The conventional method of shaping such sheets has usually been to place the material against a suitable positive or negative die, softening the sheet by applying heat more or less uniformly over the surface, and then causing it to take the shape of the die by suitably applied pressure. An alternative method has been to soften the material before placing it against the die.

With shapings that are substantially hemispherical or spherical segments, it has not been essential to use both die and pressure, but it has been possible to hold the softened material in a suitable clamp and apply the pressure by air or suitable fluid until the shape required has been obtained. This procedure has the advantage that the softened sheet is not damaged by any imperfections that may

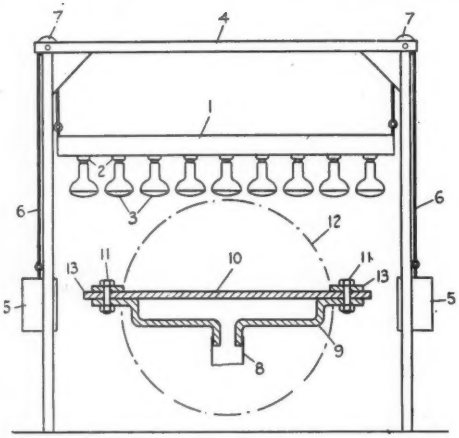


Fig. 1.

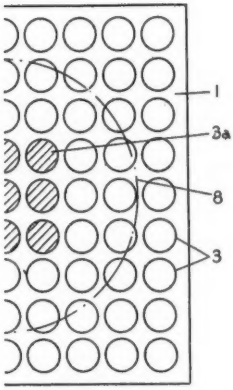


Fig. 2.

exist in the surface of the die. In these forming operations, if the material is heated uniformly it stretches more at the centre of the die than at the periphery. As a result of this unequal stretching, the product is non-uniform in thickness. This may be no objection in small components, particularly if the amount of deformation is small. With large articles, however, and especially when the extent of deformation is great, this lack of uniformity in thickness of the resultant product may be very objectionable. This is particularly the case when uniformity of strength, rigidity, optical properties or other characteristics is required.

Owing to the poor thermal conductivity of thermoplastic sheets, uniformity of heating throughout the sheet has probably never been achieved. This, generally, can be an advantage if the lack of uniformity is in the right direction. Obviously, under normal conditions it is very uncontrolled.

The patent under review covers the production of articles from thermoplastic sheet, which is heated with control of the heating in a manner to give predetermined differential plasticity to the sheet and then shaping it to the desired form. A modification of the process comprises the heating of the sheet, and thereafter cooling in a manner that gives predetermined differential plasticity and then shaping to the desired form.

In these processes the heated sheet can be shaped with a suitable positive or negative die, or it can be shaped by applying fluid pressure without the use of a die. The requisite temperature gradients in the thermoplastic sheet can be attained either by non-uniform radiant heat or by uniform heat, followed by subsequent cooling of portions of the sheet. A bank of infra-red lamps is a convenient source of radiant heat, and an appropriately designed air oven can provide for the uniform heating.

In general, the arrangement is such that greatest heating is provided in those areas of the sheet most closely adjacent to the edge of the mould, because these areas customarily undergo the least stretching. The degree of non-uniformity of the heating to obtain the desired result must be obtained by preliminary experiments.

Figs. 1, 5 and 6 show how the invention may be applied. Fig. 2 shows an arrangement of the radiant heating lamps with respect to the sheet which is being heated. Fig. 3 shows the cross-section of an article produced by orthodox methods; Fig. 4, the same by processing

according to the invention. Fig. 7 represents a plate which can be used as an air distributor for non-uniformly cooling uniformly heated sheets.

Referring to Fig. 1, which shows apparatus suitable for softening and shaping thermoplastic sheets, we see a rectangular platform support (1) equipped with light sockets (2), in which are screwed infra-red lamps (3). The wiring is such that lamps may be energized individually or in small groups. The support is mounted for vertical adjustment within the frame (4) by counterbalancing weights (5), connected to the support by ropes or wires (6) over pulleys (7). The thermoplastic material (10) is securely held across the flange (9), to which is connected a flexible pipe (8), through which air can be forced when necessary. The sheet is held by bolts (11), passing through a metal ring (13) to the flange (9).

The specific means of clamping the plastic sheet are not critical, providing that the sheet is held securely and that there is not a large air leakage when air is forced through the flexible pipe (8). Negative die (12) is fixed at right angles to the plans of the thermoplastic sheet during the heating process, and it is

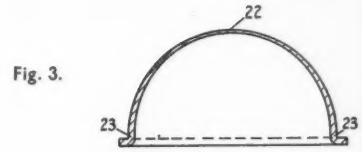


Fig. 3.

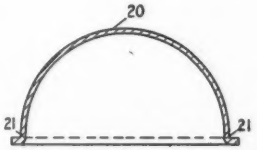


Fig. 4.

placed in such a position that, when the thermoplastic sheet has been sufficiently heated and the infra-red lamps removed vertically, if necessary the flange (9) can be positioned so that the plastic sheet covers the opening in the negative die (12). This negative die consists of a highly polished metal mould of the necessary shape; if desired, a thin film of oily material, such as petroleum jelly, may be smeared over the surface of the die before forming the sheet into it, to prevent sticking of the synthetic resin to the die.

Using a negative die, the procedure adopted for producing a moulding is as follows: The thermoplastic sheet (10) is

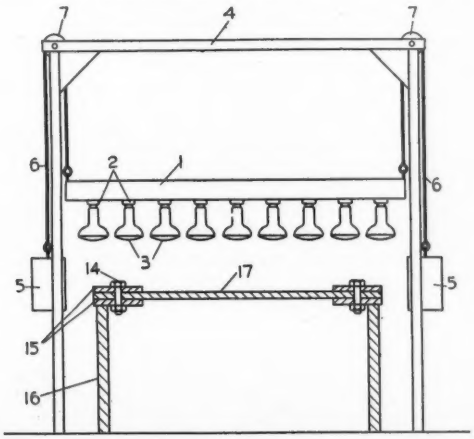


Fig. 5.

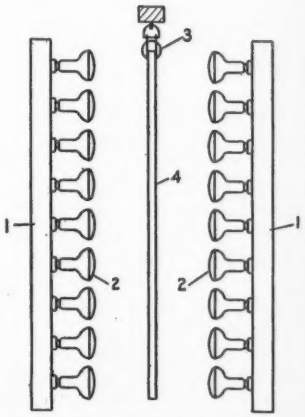


Fig. 6.

secured in position, as shown in Fig. 1, and support (1) is adjusted to bring the infra-red lamps (3) into the desired position. Certain of the lamps are energized, the number and position of them having been previously determined by trial. In this way the differential plasticity of the sheet is secured with the greatest plasticity in the portion of the sheet adjacent to the rim (13).

Fig. 2 shows the arrangement of the energized lamps (3) and unenergized lamps (3A), with respect to the sheet, for producing a hemispherical shape. When the sheet has become sufficiently heated and attained the desired degree of differential plasticity, the infra-red lamps are removed vertically and the sheet placed across the opening of the die (12); the flexible tube (8) is bent to allow the necessary movement of the flange (9) carrying the thermoplastic sheet (10). Air is then forced through the flexible tube (8) until the sheet has acquired the configuration of the die. The moulded article is allowed to cool and then removed.

Moulded articles produced by this method have a substantially uniform thickness, as shown diagrammatically in Fig. 4. Thus, the centre (20) of the article is substantially equal in thickness to the peripheral regions (21). This contrasts with the results normally obtained, which are illustrated in Fig. 3. These peripheral regions (23) are appreciably thicker than the centre (22).

Another procedure is shown in Fig. 5. In this case the thermoplastic sheet (17) is clamped between two metal rings (15) by bolts (14), and held on the support (16). The controlled means of heating is also provided. In this method, to produce a shape using a positive die, the plastic sheet is secured as shown and support (1) is adjusted to bring the infra-red lamps (3) within the desired proximity of the sheet. Certain of the lamps are then energized, the number and position of them having been previously determined by trial. In this way differential plasticity of the sheet is achieved with a conditon of greatest plasticity adjacent to the clamping rings. When the sheet has attained the desired degree of differential plasticity, it is removed from the apparatus and forced over the positive mould by applying suitable hand pressure to the clamping rings (15). The moulded sheet is then allowed to cool and is removed from the mould. Substantially uniform thickness is claimed.

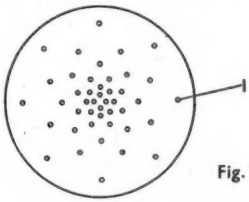
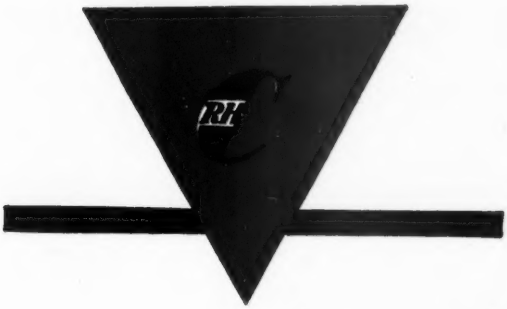


Fig. 7.

It is not essential to fix the thermoplastic sheet to the metal rings (15); it can be laid on a pad of felt or brown paper, and when it has obtained the necessary degree of differential plasticity it can be shaped, either by clamping it across the mouth of a negative die and then forcing it to assume the configuration of that die, or by clamping it in a blowing device, as indicated in Fig. 1.

The thermoplastic sheet to be shaped can also be heated by suspending it between two banks of infra-red lamps, as shown in Fig. 6, where the infra-red lamps (2) are held by supports (1); also seen, a bulldog clip or suitable clamp (3) and the thermoplastic sheet (4). This method is particularly suitable for thick sheets, since the poor heat conductivity of the resin otherwise causes undesirable temperature gradients along the axis at right angles to the surface of the material.

Another method is to heat the material uniformly in an air oven to a temperature slightly above the highest temperature required for shaping, and then to cool some portions of the sheet to a greater extent than others by subjecting them to a blast of air lower in temperature than the sheet itself. In the heating process the sheet can be supported in the oven upon a pad of felt or paper;



Message to the Plastics Industry

It is with great pleasure that we are able to announce to our friends the British Plastics Industry that

DOW CHEMICAL OF CANADA LTD.

have appointed

R. H. COLE & COMPANY LIMITED

agents in Great Britain for

POLYSTYRENE MOULDING POWDERS

available in a wide range of colours in addition to crystal

Your enquiries are cordially invited

R. H. COLE AND COMPANY LIMITED
2, CAXTON STREET, WESTMINSTER, S.W.1
Phone: Whitehall 0711/2/3 **Grams: Geratole, Phone, London**

m and i

THE MICANITE & INSULATORS COMPANY LTD.

Empire Works, Blackhorse Lane, Walthamstow, London, E.17

Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS and TERMINALS. Distributors of Micoflex-Duratube sleevings.

alternatively, it may be suspended. For the cooling, the air may be passed through a plate, as shown in Fig. 7, the plate being approximately the same size as the sheet. The plate is placed about 3 ft. from the heated sheet, so that the cooling is not localized to areas corresponding with the holes in the plate. These holes are made small in diameter, namely 1/10 to ¼ in., and their position is determined by experiment so that the desired result is obtained.

It is claimed that shapes that are substantially hemispherical or spherical segments can be readily produced without the use of a negative die by softening the thermoplastic sheet (10) (Fig. 1), as indicated in the foregoing, or with similar apparatus; then removing the infra-red lamps and blowing the thermoplastic sheet to the required dimensions without altering the position of the flange (9). Precise heating conditions have to be determined by trial. Likewise, other shapes can be produced without using the negative die by applying the differential heating in such a manner that the thermoplastic sheet is stretched to the desired shape. In this case, however, the finished article will not possess a substantial uniform thickness. By eliminating the use of the negative die, not only is it possible to produce articles free from such markings as would be due to the use of a die, but the cost of such a die is avoided, and this may be an important factor when only a few articles are required.

The present invention does not necessarily require the thermoplastic sheet to be held horizontally, nor the opening of the negative die to be in a vertical plane, although such an arrangement may generally be found most convenient. Again, the differential heating can not only be accomplished by energizing radiant-heat units in predetermined areas in a plane parallel to the sheet, but can also be achieved by placing various heating units in more than one plane at pre-determined distances from the sheet. Again, the heating may be from a plane forming a dihedral angle with the plane of the sheet.

A further extension of British Patent 569,340 covers the possibility of producing not only substantially uniform thickness of article, but also embraces the production of articles of pre-determined non-uniform thickness from a sheet of uniform dimensions. The patent is broadly applicable to the shaping or moulding of thermoplastic sheets, and has been found particularly advantageous for cellulose acetate and polymethyl methacrylate sheets.

DURESTOS

(*continued from page 286*)

wedges for electric motors; gear pinions and cams; mechanical packing, piston rings, etc.; bearing journals and bushes; press tools for sheet-metal work. At chemical works it would find use for the fabrication of tanks and as laboratory bench tops and fume cupboard panels. The cured material is machined by the technique adopted for laminates.

The tensile strength of the acid-resisting grade is unimpaired after immersion in either conc. sulphuric acid, 25 per cent. sulphuric acid, 10 per cent. hydrochloric acid, or 25 per cent. nitric acid for 30 days at room temperature. In conc. hydrochloric acid and conc. nitric acid the tensile strength is reduced to 17,000 and 10,000 lb. per sq. in. respectively.

ADHESIVE MAKERS' PANEL.—As a means of strengthening relations with industry, early in 1945 the Director of Forest Products Research formed an informal panel, the Adhesive Makers' Panel. This Panel now meets three or four times a year at the Forest Products Research Laboratory, Princes Risborough. Members are drawn from appropriate government departments and from associations concerned with the manufacture of animal, casein, synthetic resin and vegetable adhesives.

Cellulose Acetate Plastics

I.—Introductory and Historical

By
Vivian Stannett

THE latest American statistics, just published,[1] show that the production of cellulose acetate plastics in the U.S.A. during 1946 reached the staggering figure of 103,000,000 lb., whilst the total for 1947 has been estimated as 131,000,000 lb. Unfortunately, figures of British production are not available, but a proportionately large figure can safely be assumed. Equally significant is the rapid rise in production during the last 15 years, as illustrated by Fig. 1. Naturally, this meteoric increase has been paralleled to some extent by plastic materials as a whole, and in the case of the new thermoplastics, such as polystyrene and the vinyls, an even greater speed of development can be shown. Nevertheless, cellulose acetate plastics are unique when one considers the length of service they have already given and the fact that they have not only survived the continual discovery and development of other thermoplastics, but have themselves developed at a correspondingly dynamic pace.

In some fields of application, it is not certain that they can continue to hold their predominant position. One example being the obvious competition from polystyrene for injection moulding work. But it is the writer's guess that they will safely survive this and other menaces, and, in addition, their constantly expanding range of uses will more than compensate for any setbacks they may suffer. A simple example of this capacity for survival can already be given. Cellulose acetate sheeting has suffered heavy losses in the safety glass market by the development of polyvinyl butyral sheeting for safety glass interlayers, and also by the marked preference for toughened glass in Britain. Although serious, these losses have been completely wiped out by newer applications, such as the rapidly developing market for rigid transparent containers. It will be the aim of this series of articles to bring together existing information on this important class of plastic materials and to show their immense versatility and their actual and potential fields of application.

Before proceeding further, it is worth recording the 1946 American production figures for cellulose acetate plastics, grouped according to their form of production. Table 1 shows that by far the greatest proportion of the production was in the form of moulding powder, and this can readily be understood when one considers the variety of products made by the moulding process, their comparative weight, and the huge numbers now commonly turned out as a matter of course. The increasing use of the injection-moulding method is very well shown by the figures given by Mr. Islyn Thomas and published in a recent editorial of "Plastics." These figures are given again in Table 2. It would be most interesting and revealing to break down the figure of

Table 1.—Production of Cellulose Acetate Plastics in United States, 1946[1] (including mixed esters).

	lb.
Sheets (continuous) less than 0.003 ins. gauge	7,649,795
Sheets (continuous) 0.003 ins. gauge and above	7,498,529
Other sheets, rods, and tubes	4,717,401
Total ..	19,865,725
Moulding and extrusion compounds	83,204,482
Grand total ..	103,070,207

Table 2.—Injection Machines in the United States.[3]

Year	Machine
1940	450
1943	1,300
1945	1,600
1946	3,200

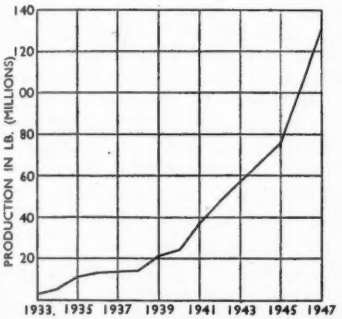


Fig. 1.—Production of cellulose acetate plastics in U.S.A.

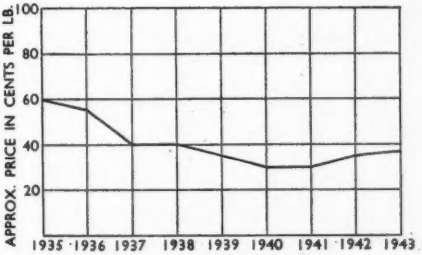


Fig. 2.—Price trends of cellulose acetate in U.S.A. (Based on figures given by Ott.[5])

83,000,000 lb. of moulding powder into the type of product moulded, but, unfortunately, such an analysis has not so far been made. But the inclusion in the list of articles commonly moulded from acetate powders of such every-day items as buttons, combs, motorcar and aircraft fittings, costume jewellery and decorations, fountain pens and toys, shows the huge market lying open to the manufacturer.

From a long-term point of view, it is perhaps unfortunate that, although the price of cellulose acetate has dropped over the past 12 years, as Fig. 2 shows, this process seems to have stopped and prices have not only been stationary, but have actually risen in recent years, even if allowance is made for the general rise in prices due to the devaluation of currency, etc. This tendency is largely due to the shortage and consequent fierce competition for the basic raw material cellulose, still almost exclusively used in the form of cotton linters. The comparatively high price of acetate powders may in the long run prove their undoing; but no doubt manufacturers are well aware of this difficulty, and will eventually overcome it with that ingenuity which they have so often shown in the past.

If a cheaper source of cellulose than cotton linters could be found, half the battle for a cheaper material would be won, but German experience in this direction during the war was not too encouraging. They certainly succeeded in using wood pulp for the greater part of their production of acetate, but it would appear that the lengthy process of purification necessary would make it an uneconomical proposition under normal circumstances. Experiments are continually going on in many countries to find other cheap sources of pure cellulose, suitable for making into acetate, including straw, grasses and potato vines, but so far without much success. However, it remains to be seen what will be the eventual outcome of these researches. The process of acetylation has been cheapened considerably over the past ten years, and a hint has recently been given of a new and much cheaper process being developed in the United States, but, so far, no details have been released.

In the case of film and sheeting, price is as yet of less importance, partly because the low density of acetate gives a reasonably large area per pound weight, as is shown in Table 3, and partly because competitive transparent sheet thermoplastics are at present equally high in price or even more expensive.

The versatility of cellulose acetate plas-

Table 3.—Area yield of Transparent Cellulose Acetate Sheet

Sheet thickness (ins.)	Approximate number of sq. ins. per lb.
2/1000	11,000
5/1000	4,400
10/1000	2,200
20/1000	1,100
60/1000	370
1/8	176

tics has already been mentioned; this shows itself particularly in the large number of ways of manufacture and fabrication which are possible. Moulded articles may be produced by injection and compression methods, and lengths of tubing, rod and shaped profiles can be readily and continuously made by both wet and dry extrusion methods. Acetate sheeting can be produced by a number of methods and the sheeting itself worked and fabricated in a variety of different ways. The ready solubility of cellulose acetate in comparatively cheap solvents, particularly, of course, acetone, further extends the range of production methods, well-known examples being the film casting process from solution, and the production of containers and similar articles by the dipping process. The gigantic use of cellulose acetate in the manufacture of rayon, and the growing application for lacquers and finishes, further indicates the scope of techniques available for its use.

These many methods of manufacture and fabrication show only one aspect of its versatility. The plastic itself can be modified and compounded in many different ways to produce materials of widely different properties. These changes are mainly brought about by (a) varying the grade of cellulose acetate used, and (b) using different plasticizers in different proportions. The colour range of acetate plastics is usually designated as "limitless" in the technical literature, and with some justification. For, in addition to the complete range of plain colours available, in transparent, translucent and opaque forms, a great number of special colour effects can also be made, including shells, mottles, horn, pearl and metallic finishes. It is intended to go into these various aspects of cellulose acetate technology in more detail later in this series, but they are mentioned briefly here to demonstrate the many ways in which changes can be rung during manufacture.

To write a complete history of cellulose acetate and its plastics would be a most tedious and difficult task. Tedious, because the subject has provided the material for a tremendous number of patents, and difficult, because the exact sequence and dates of the various key developments are often hard to determine with accuracy. The question of the true authors and owners of these discoveries and patents has long been the subject of considerable controversy and litigation. Nevertheless, it is interesting to note the general order of development.

Early history of the material is, of course, largely the history of the discovery of cellulose acetate itself and the development of new forms and new manufacturing processes. In parallel with these basic chemical developments runs the discovery and invention of methods of plasticizing and fabricating.

The earliest recorded account of the preparation of cellulose acetate is that given by Paul Schützenberger in 1865.[1] He heated cotton with acetic anhydride in a sealed tube at about 180 degrees C. until the cotton passed into solution. The cellulose acetate was then precipitated by the addition of water, separated, and dried. It may be interesting to quote here the actual description given by Schützenberger of his new product in this first paper: "La cellulose acétique est solide, blanche, amorphe, insoluble dans l'eau et l'alcool, soluble dans l'acide acétique hydraté; la potasse bouillante la décompose rapidement, avec régénération de cellulose." I think readers will agree this is a particularly neat and accurate description, considering it was made more than 80 years ago!

It is now generally considered that these early samples were considerably degraded and modified owing to the rather drastic method of acetylation used, but it was this paper which first aroused interest in the subject and on which the later work was based. Further investigations were carried out by a number of workers in efforts to improve on this method of acetylation, but the next real step forward was made in 1879 by Franchimont, when he added sulphuric acid to the reaction mixture with greatly improved results. In spite of a vast

amount of subsequent researches carried out by innumerable workers, sulphuric acid is still the usual catalyst employed to-day for the commercial manufacture of cellulose acetate.

A number of people were by this time engaged on the problem, notable among them being the two British chemists, Cross and Bevan, who published one of their first papers on this topic in 1889, where they described the use of zinc chloride as a catalyst. Their first patent on the subject was taken out in 1894, and this point is considered by Lipscomb to mark the beginning of the industrial history of the subject. A paper by Weber published in 1899 is interesting, as in it he predicts a big future for cellulose acetate as a non-inflammable substitute for celluloid, which would appear to be a considerable achievement of the imagination, considering the early date. A great many papers and patents relating to the acetylation of cellulose were issued between 1890 and 1900; these were mainly characterized by the high temperature used for acetylation, and by the fact that the products were only soluble in chloroform or similarly toxic and expensive solvents.

The next important development was the discovery in 1903 by the American chemist, Miles, that if the acetylated cellulose is hydrated by the controlled addition of water to the completed reaction mixture, a product results which is soluble in acetone. The significance of this difference in solubility is obvious, and the importance of the discovery was quickly realized. A counterclaim for the discovery was made by Eichengrün, of the Bayer Co., in Germany, but after some years of litigation the prior claim of Miles was recognized and his patents were eventually purchased by the Bayer Co. Up to 1914, this company was the only one to manufacture cellulose acetate on a commercial scale. Their product, known as "Cellit," was utilized for the production of non-flam celluloid and film and for lacquer production, but not for rayon.

The development of the aeroplane during the first world war led to the need by the Allies for non-inflammable acetate "dopes" for the treatment of aircraft wing and fuselage fabrics. This resulted in the setting up in 1916 of a British company for their large-scale manufacture. This company, under the direction of the Dreyfus brothers, successfully produced large quantities of these dopes. They also succeeded in producing the necessary extra quantities of acetic acid and anhydride by synthesis starting from acetylene. This meant the production of a large amount of calcium carbide by the company.

With the ending of hostilities in 1918, efforts were begun to find profitable new outlets for cellulose acetate, a large manufacturing capacity for which now existed. Early attempts were made to produce non-inflammable celluloid and film, but these were not immediately successful, and most of the efforts were then turned to spinning. Here, success was achieved and the commercial manufacture of acetate rayon was begun in 1919. The success of this process is now completely established, and the industry has now assumed gigantic proportions. Cellulose acetate plastics, however, had to wait a much longer time before any sort of commercial success was realized.

The continually increasing number of uses which were being found for celluloid intensified the search for a material combining the useful properties of celluloid with the additional advantage of non-inflammability. Cellulose acetate was the natural basis for this material and experiments were begun as early as 1900 to make from it a similar product to celluloid. The first experiments were aimed at decreasing the inflammability of celluloid by the addition of a substantial proportion of cellulose acetate, and a number of patents were taken out for this method. This approach was not, however, too successful, and the use of cellulose acetate alone was soon adopted as the starting point. Unfortunately, camphor was not compatible with acetate, and the search for a substance comparable to camphor for use with acetate occupied the attention of many workers, in fact even to-day no single plasticizer has been found

for use with acetate to compare in excellence with that of camphor with nitrocellulose.

Acetylene tetrachloride was used commercially in America for the preparation of non-flam acetate photographic film, but, owing to this having the comparatively low boiling point of 147 degrees C., it was not permanent and the film soon became brittle. However, this "plasticizer" was used for the commercial production of photographic film up to and during the first world war.

It was natural that the manufacturing processes used for celluloid should have been adopted for use with acetate, and, in addition to the film-casting process, the block method of making sheeting was used from about 1918 onward for acetate plastics. The early products, however, were not very successful, owing to the lack of suitable plasticizers, and the sheeting thus made was found to warp and weather badly. More suitable plasticizers, such as combinations of alkyl phthalates and triphenyl phosphate, were eventually tried, and, about 1927, acetate sheet of reasonably good quality was successfully made by the block process on a commercial scale. About the same time, rod and tubing made by the wet extrusion process, as used for celluloid, was also produced. A year or so later, powders, suitable for compression moulding, were marketed and found a limited outlet.

The method of injection moulding which was developed by Eichengrün, and first patented by him in 1920, represented a very big development in the history of plastics as a whole, and with cellulose acetate plastics in particular. The method, however, did not immediately come into wide use, owing to the lack of suitable powders and a general apathy on the part of moulders. By 1933, the injection-moulding method had begun to completely establish itself. When the original Eichengrün patents finally expired in 1936, the industry received a fresh impetus, and, since then, injection moulding has become of rapidly increasing importance, as the figures given in Table 2 will show.

Another important outlet of cellulose acetate was found in the manufacture of sheeting for laminated safety glass. Celluloid had been used as the interlayer for some years, but had proved unsatisfactory owing to its tendency to become yellow and to discolour generally on ageing. After some difficulties, due to the lack of a satisfactory adhesive, acetate was eventually well established for this application, and large amounts were absorbed by the industry, particularly during the period 1934 to 1938. The new method of sheet production by continuous extrusion was started up in the United States in 1934, and was chiefly used for safety glass interlayer grades. However, this application was not to last, owing to the brittleness of acetate at low temperatures, and certain other disadvantages, such as poor moisture resistance and unsatisfactory adhesion. Because of these disadvantages, a search was begun in the United States for a more suitable plastic interlayer, which culminated in 1939 in the successful development of polyvinyl butyral sheeting. This has now largely superseded acetate for safety glass manufacture, although the latter is still used for certain types of work.

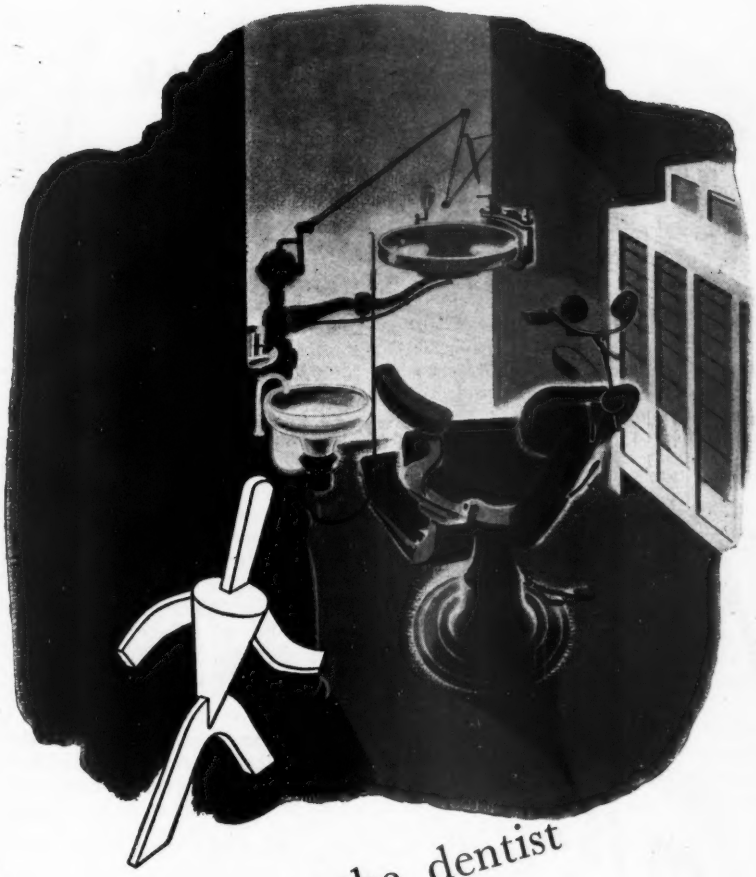
The range of methods available for the manufacture of acetate plastics was further extended when the "dry" extrusion of rod, tubing, ribbon and shaped profiles directly from moulding powder was begun commercially in 1939. This brings this brief history of cellulose acetate and its plastics nearly up to the present day. Improvements and developments are still being made, and the post-war period has already seen the publication of new methods of sheet extrusion and of moulding powder manufacture.

(To be continued.)

REFERENCES

(1) *Modern Plastics*, 1947, **24,** 119. **(2)** *Modern Plastics*, 1947, **24,** 104. **(3)** *Plastics*, 1947, **11,** 172. **(4)** *Compt. rend.*, 1865, **61,** 485. **(5)** *Ind. Eng. Chem.*, 1940, **32,** 1641.

(*General*) *Worden, Technology of Cellulose Esters, Vol.* 8; *Lipscomb, Cellulose Acetate*, 1933.



Plastics go to the dentist

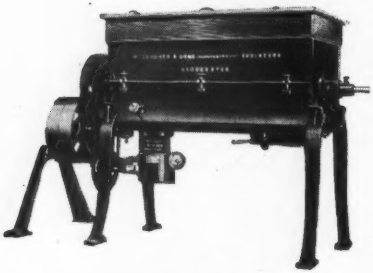
Acrylic plastics' first appointment with the dentist was made by I.C.I. in 1935. In the familiar form of "Kallodent" and "Kallodentine" they are now universally used. Their success in this field is yet another example of the versatility of plastics.

ICI

P.230

IF...

UNIFORM FEEDING OF MATERIAL IS NECESSARY ...



If your product demands uniform feeding of material stipulate GARDNER Patent "Diaphragmic" Feeder & Measurer. This model embodies many new features, and is far superior to any other, because a specially designed pressure balance chamber reduces variation of discharge to a minimum, no matter what the amount of material in the mixer portion. Opening discharges are controlled by micrometer adjustment. Specially designed multiple discharging vanes ensure NON-STOP discharge of material.

This particular model, like all GARDNER machines, has the GARDNER hall-mark of perfect performance, long working life, free from trouble or repair.

Write for fuller information and illustrated catalogue.

SO IS...

GARDNER'S PATENT "DIAPHRAGMIC" FEEDER & MEASURER

WM. GARDNER & SONS (Gloucester) LTD., BRISTOL ROAD, GLOUCESTER
Telephone: 2288 (3 lines). *Telegrams: "Gardner, Gloucester."*

LONDON: 19, Gray's Inn Chambers, 20, High Holborn, W.C.1. **Telephone: Chancery 7347.**

Book Reviews

"Plastics Moulds—Design, Construction and Use." By Gordon B. Thayer. Third Edition. pp. 272. Huebner Publications, Ltd., U.S.A. (Distributed in British Empire by Machinery Publishing Co., Ltd., West Street, Brighton, Sussex). 30s.

Mr. Thayer, who is now plastics research engineer of the Dow Chemical Co., fully deserves this third edition for the good reason that it is a good book. Moreover, it is, for very obvious reasons, a much-expanded edition in the light of new processes and modified ones. The whole is an extremely practical work by a very practical plastics engineer, who, while he has himself written most of it and has a wide knowledge of all methods, is wise enough to allow certain specialists to assist him with special chapters.

A most interesting introductory chapter is that on suggestions on design procedure and practical points in mould design and construction, segregated for the designer, the toolmaker, the operator, the estimator and the inspector. These practical points or "laws" could well be reprinted and distributed for works procedure with excellent effect. We have never before seen them put so concisely and orderly.

The chapters that follow include the design of a simple compression mould, of split-cavity and side-opening moulds, of transfer types, of various injection moulds, including special ejector systems, of mould-building methods and equipment. The completing chapters include finishing chromium plating, a very valuable one on plastic tooling, and finally one on estimating the man-hour costs of moulds, dies, fixtures and other special equipment.

"The Microscope: Its Theory and Applications." By J. H. Wredden. pp. 296. J. and A. Churchill, Ltd. 21s.

The author of this book is known to readers of "Plastics" from his contributions on "The Microscopic Examination of Plastic Materials," which have appeared regularly each month since July, 1945. That Mr. Wredden is an expert in the use of the microscope will already have been apparent to readers by the excellence of the photomicrographs which have accompanied these articles. The book under review confirms this, for it is certainly a scholarly treatise on the technique of handling the microscope, written not only to provide general information about theory and construction, but also to set down a number of more unorthodox applications and processes which the author has developed as a result of constant use of the instrument. The individual chapters relate to elementary optics, the compound microscope, eyepiece, objective, sub-stage condenser, illumination, the microscope stand and mechanical parts, general use, polarizing microscope, micrometry, photomicrophotography, and the preparation of specimens, the text being accompanied by nearly 300 illustrations.

"Practical Plastics Illustrated." Edited by by Paul I. Smith. pp. 320. Odhams Press, Ltd. 10s. 6d.

Thirteen authors contribute to this "guide to the principles and practice of modern plastics," which includes nearly 250 illustrations. The book is primarily intended for those who are already engaged in one of the many branches of the plastics industry, but the subject matter has been so graded and arranged that it is conveniently read from the semi-technical viewpoint of those who are about to enter the industry. Its scope ranges from chemistry underlying the production of basic raw materials to actual moulding and fabrication. The editor himself contributes an introduction and a further section on "Plastics in Industry," together with a short glossary. The remaining contributors are: G. T. Beach, J. H. Collins, D. N. Davies, J. Maitland Edwards, A. O. R. Johnson, J. L. Daniels, R. H. Streete, S. R. Badley, O. V. Langford, W. J. Brown, W. J. Brierley and J. Poole.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired.

Acid-proof Containers

Sir,—I would be grateful if you would give me guidance in the following matter: My Swiss partners are highly interested to place considerable orders in this country for plastic 6-gallon containers which are acid-proof, heat-resisting (90 degrees C.), and can withstand an internal pressure of 1½ atmospheres.

I was told that the American plastics industry has already developed material which meets the aforementioned requirements. Can you give me the names of firms, preferably with a London office, which you know are able to supply the goods in question and with which I could discuss the matter? E. I. MICHEL.

9, Edmunds Walk,
London, N.2.

[EDITOR'S NOTE The large size of container required excludes casting processes for the time being. A possibility is the use of the post-forming process and the application of special sheets, such as Durestos—a product of Turner Brothers' Asbestos Co., Ltd. Thermoplastics, Ltd., of Dunstable, are working on this material for similar jobs.]

Welded Plastic Raincoats

Sir,—We note that the March issue of "Plastics" (page 123) features the welded plastic raincoat.

We would like to say that we are large stockists of these welded garments, having had considerable experience in this trade, and we are now able to deliver to any inquiries you may receive.

In our opinion, this welded plastic raincoat will take the place of the stitched variety; it has, of course, been extensively and successfully tried in America for a number of years.

The firm producing these raincoats are prepared to guarantee that the seams will not give way, and that the garment is practically untearable through normal use and is completely waterproof. It will be replaced if returned by the customer for any genuine complaint.

We think this is the first time any manufacturer has been able to give such guarantee in plastic rainwear, and this should bring confidence back to the retail purchaser.

There is, of course, a tremendous variety of other merchandise that can be produced on this high-frequency welding, and development is going forward rapidly on these lines.

W. H. CARTER AND CO., LTD.
47, Market Street,
Manchester, 1.

[EDITOR'S NOTE: We congratulate W. H. Carter and Co. in being able to guarantee these coats, which is obviously the next step in obtaining the confidence of the public.]

Radio Cabinets

Sir,—In the issue of "Plastics" for May, 1947, we have read with interest your editorial entitled "Radio Cabinets" and note that the application of laminates for such cabinets "have never, so far as we know, appeared in the picture."

We hasten to advise you that we have for some considerable time now been producing and supplying to the radio trade, cabinets—table models as well as consoles—fabricated from laminates, both of the phenol type, such as "Delaron," and the decorative materials, such as "Traffolyte," which latter can, of course, be obtained in colour tones, "wood finish" and real wood finishes.

The design of cabinets has been of such a nature as to permit of quantity production, and examples have been exhibited at our Stand No. 798 at the B.I.F. at Earls Court. Our method of construction permits incorporation of colour schemes in part, or in whole, and to customer's requirements. Further, as

you are aware, the durability and serviceability of these laminates exceeds those of cabinets of timber construction with particular reference to tropical conditions. In addition, in our opinion, the surface finish is considerably superior to any moulded cabinet, being free from "orange peel" effect.

One further point which may be of value to your readers is that in the event of a change of design being required—far less cost is involved for such changes in that there are, of course, no expensive moulding dies.

HILL NORMAN AND BEARD PLASTICS, LTD.
13a, Kilburn High Road,
London, N.W.6.

[EDITOR'S NOTE: We apologise for our laxness in not seeing this type. We have now rectified this fault and congratulate Hill Norman and Beard Plastics, Ltd., on their work.]

Dyeing Cellulose Acetate

Sir,—We should be grateful for a method of dyeing cellulose acetate which would permit of subsequent polishing of the moulded object. O.C., LTD.
Clerkenwell.

[EDITOR'S NOTE: Dyeing of acetate with acetone soluble dyes should be carried out using acetone-water mixtures, careful control of period of dipping, and rapid rinsing in water.]

Manufacturing Licences

Sir,—We are preparing to start manufacturing plastic goods from sheet, rod, tube and profiles. We are not sure of our position regarding the Board of Trade, and would be obliged if you will inform us if permission has to be obtained from the Board of Trade before commencing to manufacture plastics goods for home and/or export.
Manchester, 18. R.A.W.

[EDITOR'S NOTE: Manufacturing licences where necessary are issued by the Board of Trade, and full details are given in the following pamphlets, ' obtainable from H.M. Stationery Office: The Miscellaneous Goods (Prohibition of Manufacture and Supply) (No. 7) Order, 1945 (S.R. and O., 1945, No. 1176) and the like-named, amending (No. 10) Order, 1946 (S.R. and O., 1946, No. 1994.)]

Lavatory Seats

Sir,—It has come to the notice of this committee that plastic w.c. seats with recessed undersides are being fitted in some of the new houses. As these seats do not conform with British Standard Specification 1254, and from the hygienic point of view are undesirable, this committee would appreciate your co-operation in their efforts to advise architects and builders how anxious they are that only seats with flat undersides and open front be fitted.

The committee appreciates the shortage of supplies of equipment, but would like to feel that your readers would, in future, manufacture all seats with flat undersides and open front.

MILLICENT PLEYDELL-BOUVERIE,
Chairman, Housing
Sectional Committee,
National Council of Women of Gt. Britain, 4, Manchester Square, W.1.

"Perspex" for Roof Lights

Sir,—Clients of ours in South Africa who are large users of roofing glass, in connection with various building contracts, are interested in the import of "Perspex," which they believe is now being used in place of glass for roofing purposes and is being manufactured in both plain and corrugated sheets.

They wish us to send them particulars of material suitable for vertical glazing of saw-tooth roofs for factories, or dead lights in sloping roofs, i.e., delivery, price, sizes and, in the case of the corrugated sheets, what type of corrugated asbestos or iron it is made to fit.

JOHN PALMER JUNR. AND CO.
Imperial House,
Dominion Street, E.C.2.

[EDITOR'S NOTE: All necessary information can be obtained from I.C.I. Plastics Division, Welwyn Garden City.]

Coating for Glass Articles

Sir,—We should be glad if you could recommend us a London firm who could undertake to coat glass articles with transparent plastic. R.

[EDITOR'S NOTE: Apparently it is desired to protect the contents of glass containers. While it seems a pity that plastic containers are not desired (certain plastics would prove quite suitable and so avoid an additional process), there are both dipping and spraying methods which should be adequate. The former entails the use of ethyl cellulose and other plastics modified to obtain a fairly low melting point, while the latter is that which has been brought into prominence by Schori, Ltd., who claim successfully to spray most plastics—and more recently polythene, on to almost any surface.]

School Ink-wells

Sir,—We have an inquiry for plastic ink-wells in connection with the Ministry of Education school furniture, and should be pleased if you could put us in touch with the name of a likely manufacturer.

I. WARSHAW AND SON, LTD.
319-321, Old Street, London, E.C.1.

Plastics and Coupons

Sir,—Inquiries we have made have failed to discover the existence of any specific organization which exclusively represents the interests of a very considerable and important branch of the plastics industry. We refer to the manufacturing and marketing of goods from p.v.c. sheeting and allied materials.

It is noteworthy that during a continued period of acute shortages, products made from p.v.c. have enjoyed much public favour, despite some limitations. Since clothing coupons have now to go farther, they will have to be spent more economically. However, garments, etc., made from textiles are likely to be inadequate for home consumption with the increasing export demands.

Here plastics, properly applied, can doubtless do a grand job—if designs and suitable applications are properly regulated. A co-operative effort, therefore, appears to be desirable, and, in a wish to explore the possibilities of "getting together," we would like to have the views of other firms on a matter which, collectively, might best serve the whole community.

B. LIPMAN (PLASTICS), LTD.
325, Upper Street,
Islington, N.1.

Tubes for Plating Baths

Sir,—With reference to your article in "Plastics," May, 1947 (page 235), concerning a remedy for plating-bath trouble, can you tell us if these polystyrene tubes are obtainable in this country?

MOORE AND WRIGHT (SHEFFIELD), LTD.
127, Trafalgar Street,
Sheffield, 1.

[EDITOR'S NOTE: The article referred to dealt with an American device which may be patented, and inquiries should be made. Polystyrene tube is available (probably from BX Plastics, Ltd.), and probably polythene tubing would be equally suitable. Low specific gravity and resistance to acid are the criteria.]

Bristles

Sir,—Could you tell us who would supply "pins" of the type enclosed? We would require a minimum production of 500,000 such "pins" per month.

THE BROADWAY WAREHOUSE CO.
Kinsbourne Green,
Harpenden, Herts.

[EDITOR'S NOTE: The object is stated by the inquirers to be a brush bristle, but we admit we have not yet seen a brush containing them. The "pin" is of cellulose acetate or some similar plastic and is injection-moulded.]

Plastic "Leathers"

Several readers having inquired for the address of Etablissement Coria mentioned in our February issue (page 65), we have now been informed that this is 8, Rue la Boetie, Paris. It is also confirmed that the "leathers" are constituted from phenol furfural and polyvinyl alcohol.

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

POLISHING OF PLASTICS.—General procedure for polishing the main types of plastics in common use are outlined in a 32-page illustrated brochure issued by W. Canning and Co., Ltd. Small articles that do not tend to interlock and are without sharp edges or projections are usually polished in revolving barrels, this being the most economical way of handling mass-produced repetition parts with the minimum of labour. The barrel finishing of plastics, as with metals, generally involves a preliminary "tumbling" to remove fins or flash, followed by a scouring operation with mild abrasive, and final polishing process. In the case of "Bakelite," "Beetle," casein and similar plastics of a fairly hard nature, for scouring the charge is made up with 1 to 1½ lb. of powdered pumice and ¼ lb. of "shavings" to every 10 lb. of articles, the shavings being of the particular plastics under treatment; here, barrelling is continued for 24 hours. Polishing is carried out in a similar wooden barrel lined with felt, 1 to 1½ lb. of coarse "shavings" (or wood sawdust), ¼ to ½ lb. of stearine oil, and ½ lb. of finest polishing chalk being used to every 10 lb. of articles, the barrel being continuously rotated for 8 to 10 hours. As a general rule, the peripheral speed of the barrel should be about 200 ft. per minute.

ANGLO-DANISH EXHIBITION.—Arrangements have been made, with the approval of the British and Danish Governments, to hold an All-British Exhibition in Copenhagen in September, 1948. The exhibition will be organized by the British Import Union of Copenhagen in collaboration with the Federation of British Industries.

CASEIN BUTTONS AND BUCKLES.—The Board of Trade, in consultation with the Central Price Regulation Committee, have made an Order fixing manufacturers' maximum prices for casein buttons, buckles and slides at 5 per cent. above the cost of production and sale. Distributors' margins will continue to be controlled by the provisions of the General Apparel, Furnishings and Textiles (Wholesalers' and Retailers' Maximum Prices and Charges) Order, 1946 (S.R. and O. 1946 No. 1747) which fixes, under the heading of haberdashery maximum margins on cost of 29.04 per cent. for the wholesaler and 50 per cent. for the retailer. The Casein Buttons, Buckles and Slides (Manufacturers' Maximum Prices) Order, 1947 (S.R. and O. 1947 No. 949, Stationery Office, price 1d.) came into operation on May 26.

"VERSATILITY" is the title of the latest pamphlet issued by the British Industrial Plastic group of companies describing the raw materials made and the finished moulded and fabricated goods manufactured from them. This is a beautifully produced compilation in colour and the word "versatility" becomes an almost modest expression for the kaleidoscopic nature of the industry of urea resins. There are over 130 photographs of different moulded objects under the following headings: "For table and picnic," "Trays and kitchen ware," "Lampshades and light fittings," "Moulded boxes and containers," "Cosmetics and displays," "Door furniture," "Beetle out of doors," "Mouldings for the home" and "Clocks." There are also sections dealing with Beetle sheet and extruded tube, moulded buttons and cements.

MONSANTO CHEMICALS, LTD., held their 13th annual general meeting in London on March 25. Dr. L. F. Nickell, who presided, said that in spite of all handicaps the year has been a record one. Regarding short-term developments, although much still remains to be done, progress already made has been chiefly responsible for the satisfactory increase (35.5 per cent.) in the company's business, and the increase (80 per cent.) in trading profit; with this increase, 33 per cent. was direct export business.

After depreciation of £69,343, and provision for taxation of £572,859, the accounts for the year ended December 31, 1946, show a profit of £237,878 (£94,337); surplus and reserves of £1,503,284 (£1,046,034); current liabilities and provisions of £846,662 (£811,168); and current assets of £1,765,368 (£1,490,101). Tax-free final dividend of £70,000 on the ordinary shares recommended by the directors.

The retiring directors, Dr. W. H. Garrett and Mr. Alfred D. Daysh, were re-elected.

E. K. COLE, LTD., held their annual general meeting at Southend-on-Sea on March 18, when Mr. E. K. Cole, chairman and managing director, presided. The trading profit for the year ended September 30, 1946, amounts to £160,392, as compared with £265,500 for the previous financial year. Net profit, after providing for all expenses, including depreciation—but before taxation —amounts to £122,016, as compared with £228,465. Net profit, after deduction of income tax, is £60,516, as against £97,465 for 1945.

Much progress has been made in the company's Plastics Division. Technical skill in this field has resulted in an increased turnover, further establishing the company as trade moulders as well as moulders of plastic fancy goods. In addition to producing plastic cabinets for several leading radio companies, large quantities of cabinets have been made for Ekco radio receivers. However, said Mr. E. K. Cole, it must be recorded that powder supplies are likely to be limited in the immediate future.

LANSIL, LTD., manufacturers of cellulose acetate, registered in 1928, has issued the balance of its authorized capital in £1 ordinary and 1s. deferred shares to the Distillers Co., Ltd., and the British Xylonite Co., Ltd., in the proportions of 60 and 40 per cent. respectively. The issue consists of 203,367 ordinary £1 shares and 514,000 deferred 2s. shares. The authorized capital of Lansil, Ltd., totals £1,250,000, of which only £100,000 is in deferred shares. The company has made material progress. Dividend on the deferred capital for four years up to March 31, 1946, has been 15 per cent. The proceeds of the share issue will be devoted to modernization and extension of the company's plant at Lancaster.

LACRINOID PRODUCTS, LTD., announce dividend for year ended December 31, 1946, at 10 per cent., less tax (previous, 10 per cent.). Net profit for the year was £18,113, after taxation amounting to £27,500 (previous, £9,350, after taxation £8,125).

GLOSTICS, LTD, has been registered as a private company, with offices at Abbey Churchyard, Bath, to carry on the business of importers, developers, producers, and sellers of plastic bases and compounds. Nominal capital, £5,000 in £1 shares. Directors: G. G. Seymour, 6, Holland Road, St. Saviour's, Bath, and R. N. Carter, 6, Hensley Road, Bath.

A. C. WICKMAN, LTD., Coventry, announce that they have been appointed sole agents in this country, the British Empire and Europe (excluding Russia) for "Hufford" hydraulic stretch-forming machines, designed and manufactured by Hufford Machine Works Inc., California. These machines are designed for the stretch-forming of narrow, extruded or rolled sections and mouldings, or narrow sheet metal strips. Angles, channels, hat, U, I and T-sections, as well as more complex shapes with varying amounts of curvature, can be dealt with.

DENNY, MOTT AND DICKSON, LTD., state that Mr. H. R. Adams has been appointed to assist Mr. W. R. Bousfield in the management of their Plywood, Wallboard and Plastics Department.

Personal Notes

MR. H. COURTNEY BRYSON, of Bryson Processes, Ltd., Irthlingborough, Northants, has now returned to this country after an absence of some months. During his stay in Portugal he commenced the manufacture of a series of synthetic resins, emulsions and sulphonated products, in each case the first of the kind to be made in that country.

MR. R. STAMMERS, A.M.I.C.E., who recently resigned his position as director and general manager of Lagonda, Ltd., will shortly be taking up duties in a similar capacity with Fielding and Platt, Ltd., of Gloucester, hydraulic engineers. Mr. Stammers was for many years with the Bristol Aeroplane Co., Ltd.

MR. MALCOLM DUNBAR, who has been 40 years with L. Oertling, Ltd., including 28 years as managing director, retired under the age limit on April 6. His direction of the firm coincided with major developments in balance technology.

MR. P. A. DELAFIELD has been appointed a director of British Geon, Ltd.

MR. GEORGE B. E. SCHUELER has changed his address to 126, Torrington Park, North Finchley, London, N.12 (Telephone, Enterprise 4664).

MR. F. W. PUNFIELD, chairman of Punfield and Barstow (Mouldings), Ltd., died on May 9. He was one of the pioneers of the plastics industry, having been in the trade since 1896.

New Productions from the Moulding Shops

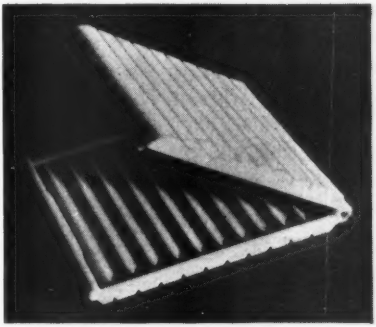
Bed Warmer

The electrical bed warmer which we illustrate has been introduced to take the place of the rubber hot-water bottle, which it follows in outline and appearance. The makers, R. A. Rothermel, Ltd., Canterbury Road, London, N.W.6, claim that it is perfectly safe and foolproof, and that in use it maintains a steady and constant heat, which is automatically controlled for as long

as the current remains switched on. In case of sickness, a constant heat day and night may be very desirable. As a substitute for the rubber bottle, refilling with hot water is avoided; the danger of scalding, by perished rubber or a loose stopper, is also eliminated. The body, in two identical halves, is moulded in Bakelite material by Insulators, Ltd.

Novelty in Cigarette Cases

This cigarette case is a new design by Barclay-Stuart (Plastics), Ltd., South Place, London, E.C.2, produced by injection moulding at their works at Luton, Beds. The material is cellulose acetate, in pastel shades



or clear. The method of closing is novel, and claimed to be very reliable. The case is moulded in two parts (using a two-impression mould), and has an undercut, which secures proper closing by a spring effect, due to the nature of the acetate material. Cigarette cases of this pattern were shown in the Plastics Section at this year's British Industries Fair, and there attracted the attention of H.M. Queen Mary, who bought three of them, her choice in the matter of colour being peach and blue.

"Perspex" Lavatory Seat

We have just received from Thermo-Plastics, Ltd., of Dunstable, an example of the lavatory seat this concern exhibited in the Plastics Section of the British Industries Fair at Earls Court. It is a beautifully executed job, in a pastel shade of green

"Perspex" for seat and lid, which are provided with rubber protecting studs. Apart from its general aesthetic value, it is very light, and designed to provide for ease of cleaning.

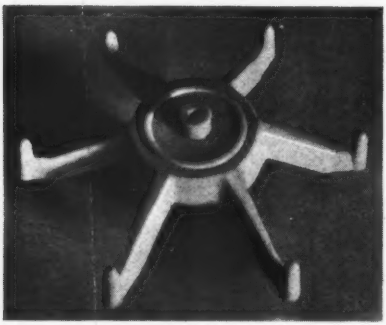
"Metal" Decorations on Plastics

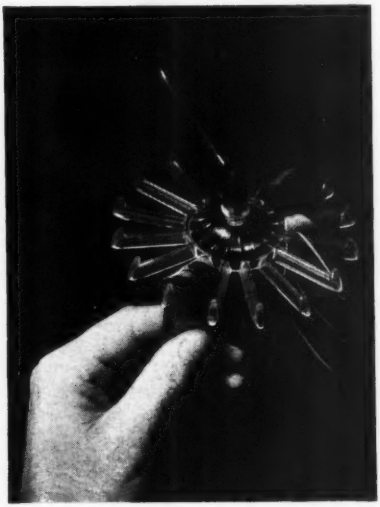
The Superb Stamping Co., of 84, Highbury Park, London, N.5, has sent us several examples of stamping metal decorations on plastics, including phenolic mouldings, "Perspex," cellulose acetate, etc. The results appear excellent, especially since some of

the designs are delicately reproduced as "silver" lines on black or white backgrounds, and are obviously suitable for pharmaceutical and perfumery bottle and other container lids, and for generally high-class publicity.

Plastic "Spider"

We have picked up in a large stores a cellulose acetate injection moulded "spider" for hanging household gadgets. The "spider" is fixed to the underside of a shelf





with a screw and revolves when required. While the idea is not new (metal "spiders" for hanging ties are often incorporated in wardrobes) the object is singularly attractive for injection moulding, since from a moulding engineering point of view the runners are the centre supports and the end of the arms form natural vents.

The second photograph (above) shows an American form, which has been sent to us by Mr. Islyn Thomas, of The Thomas Manufacturing Corporation, of Newark, New Jersey, U.S.A. In this instance there is a supporting bracket, so constructed that the "Spider" may be rotated for the convenient selection of any particular tie.

"Bakelite Progress"

The May, 1947, issue of this house journal of Bakelite, Ltd., is full of good things, especially an interesting article entitled "Printing from Plastics," which deals with the making of reproductions of type formes and half-tone blocks by the use of Bakelite sheet. An illustration of what can be done by this method is exemplified by a four-colour reproduction of a painting. A special page entitled "Plastics Parade" shows a number of the latest mouldings made from Bakelite moulding powders. These include an electric bed-warmer shaped like a hot-water bottle, a new radio-cabinet, an electric-heater wall mounting, an electric sterilizer and a desk-lamp.

Round the World with TRAPINEX

BURMA, IRAN, PORTUGAL, SPAIN, FRANCE, HOLLAND, NORWAY, S. AFRICA, CEYLON AND 23 OTHER COUNTRIES

Trapinex Paint Transfers provide the modern method of marking first class products in brilliant effect, truly worthy of the greatest names in industry. *A first class Product deserves a first class mark.* That is why the manufacturers of Nu-Swift Fire Extinguishers featured here, and many other leaders in all industries pin their faith to Trapinex Paint Transfers for capitalising their goodwill throughout the world.

Trapinex Paint Transfers are produced in special paint many times brighter than ink, and offer brilliant colour effects in any number of colours together with bold relief and cut-out design. No film or paper background mars the distinctive effect. Because they are paint, Trapinex Transfers withstand weather and the colours are fast.

Brilliant, Durable, Weatherproof and so easy to apply. Every industry has a 1000 and one uses for Trapinex Paint Transfers for publicity, display and packing.

Advice freely given, but when you write for prices please state (1) Size, (2) Quantity, (3) Number of colours, (4) Purpose, (5) Wording required, (6) A rough sketch would help. We have no Stock Lines or Price Lists.

TRAPINEX (Regd.) Paint Transfers are fully patented and manufactured only by

TRAPINEX LTD., Commerce Works, High Rd. (opposite Town Hall), Wood Green, London, N.22

'Phone: Bowes Park 6811 'Grams: Trapinex, Wood, London Cables: Trapinex, London

TRAPINEX FOR ALL MARKETING PROBLEMS!

POLYVINYL CHLORIDE SHEETING

FOR CURTAINS & OTHER FURNISHINGS FOR NURSERIES, BATHROOMS, ETC.

Also available, Thick Plastic Material for Bag Making, Fancy Goods, Upholstery and Similar Purposes.

Simco Plastics

22, ST. GILES HIGH STREET, LONDON, W.C.2

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London W.C.2, price 1/- each.

B.P. 585,753. Application date: 9.5.44. Convention date (U.S.A.): 13.5.43. Accepted: 24.2.47.

Thermoplastic Vulcanizate. C. C. Clark. To: The Mathieson Alkali Works.

Thermoplastic vulcanizate produced by heating sulphur with a copolymer of butadiene and a nuclear chlorinated styrene containing 5-40 per cent. of chlorine and 10-50 per cent. of sulphur by weight. This vulcanizate may usefully be employed in the manufacture of battery boxes, piping, valves and fittings, tanks, tank linings and also as a binder for abrasive wheels and blocks.

B.P. 585,755. Application date: 31.7.44. Convention date (U.S.A.): 30.7.43. Accepted: 24.2.47.

New and Useful Interpolymers of Vinyl Thiol Esters. To: Imperial Chemical Industries, Ltd.

Production of interpolymers of vinyl thiol esters by polymerizing through the influence of heat or light a vinyl thiol ester of an aliphatic monocarboxylic acid (vinyl thiol acetate) in admixture with an ester or anhydride of a 1, 4-butenedioic acid (diethyl fumarate, maleate or maleic acid).

B.P. 585,814. Application date: 17.1.44. Convention date (U.S.A.): 16.1.43. Accepted: 25.2.47.

Production of Solid and Semi-solid Polymers and Interpolymers of Ethylene. To: Imperial Chemical Industries, Ltd.

Manufacture of solid and semi-solid polymers and interpolymers of ethylene by polymerizing ethylene containing not more than .1 per cent. (by volume) of acetylene alone or mixed with other compounds at elevated temperatures and pressures in the presence of oxygen or a peroxide compound as catalyst. The ethylene used is obtained from coke oven gas and freed from acetylene by scrubbing with dialkyl formamide until it contains not more than .1 per cent. of acetylene.

B.P. 585,869. Application date: 3.5.44. Convention date (U.S.A.): 19.3.43. Accepted: 27.2.47.

Improvements in Moulding Reinforced Articles from Resinous Plastic Material. To: Wheeling Stamping Co.

Production of rigid cuplike moulded plastic articles from a blank formed of a flat sheet of fibrous material impregnated with a resinous compound, subsequently applying an adhesive material containing furfural, applying a layer of moulding powder to the adhesive and shaping and moulding the composite sheet in a heated mould.

B.P. 585,870. Application date: 4.5.44. Convention date (U.S.A.): 30.7.43. Accepted: 27.2.47.

Improvements in or relating to Method and Apparatus for Producing Moulded Products. P. H. Bilhuber.

Bag moulding of articles using high-frequency heating.

B.P. 585,969. Application date: 1.9.44. Convention date (U.S.A.): 1.9.43. Accepted: 3.3.47.

Preparation of Olefine Polymers. To: E. I. Du Pont de Nemours and Co.

Manufacture of solid polymers and interpolymers of ethylene by heating an olefine alone or together with an ethenoid compound in a medium containing tertiary butyl alcohol, at elevated temperature and superatmospheric pressures in the presence of oxygen or peroxide compounds as catalyst. Another catalyst mentioned is M-chloroaryl sulphonamide. The products so obtained have improved film and fibre-forming properties.

B.P. 585,991. Application date: 15.5.43. Accepted: 4.3.47.

Improvements in and relating to Mouldable Plastic Compositions. R. Snadow. To: British Thomson-Houston Co., Ltd.

Mouldable plastic composition produced from a thermo-setting mixture of alkyl and/or aryl silicones.

B.P. 586,028. Application date: 21.4.44. Convention date (U.S.A.): 22.7.43. Accepted: 5.3.47.

Process for the Lamination of Plastic Sheet Material. To: E. I. Du Pont de Nemours and Co.

B.P. 586,146. Application date: 7.8.40. Convention date (France): 7.9.39. Accepted: 10.3.47.

Improvements in or relating to the Catalytic Polymerization of Unsaturated Organic Compounds. To: Les Usines de Melle.

Polymerization of vinyl compounds using peroxide catalysts. Examples quoted: peroxides of 1:4-dioxane, 1:3-dioxolane, 2.2.5.5-tetramethyl-1.4-dioxane, 2.5-dimethyl-1.4-dioxane, or 2.2-dimethyl-1.3-dioxolane.

B.P. 586,158. Application date: 17.1.44. Accepted: 10.3.47.

Improved Apparatus for the Extrusion of Non-Metallic Plastic Materials. J. L. Packer and H. McD. Steward. To: British Insulated Cables, Ltd.

Screw extruder for plastics in which part of the screw and part of the wall of the barrel form or carry co-axial electrodes for H.F. heating.

B.P. 586,187. Application date: 29.10.43. Convention date (U.S.A.): 29.10.43. Accepted: 11.3.47.

Improvements in and relating to Organo-Silicon Compounds. To: British Thomson-Houston Co., Ltd.

B.P. 586,188. Application date: 29.10.43. Convention date (U.S.A.): 29.10.42. Accepted: 11.3.47.

Improvements in Cyclic Polymers of Dimenthyl Silanone and in Methods of Preparing the same. To: British Thomson-Houston Co., Ltd.

B.P. 586,189. Application date: 29.10.43. Convention date (U.S.A.): 29.10.42. Accepted: 11.3.47.

Improvements in and relating to Polymers of Dimethyl Silanone. To: British Thomson-Houston Co., Ltd.

B.P. 586,196. Application date: 7.7.44. Convention date (U.S.A.): 10.11.43. Accepted: 11.3.47.

Improvement in Method of making Resin Impregnated Fabrics. To United States Rubber Co.

B.P. 586,198. Application date: 10.7.44. Convention date (U.S.A.): 10.7.43. Accepted: 11.3.47.

Production of Modified Cellulosic Materials and Articles having improved Chemical and Physical Properties. To: Imperial Chemical Industries, Ltd.

Chemically modified cellulosic material produced by heating a cellulosic material with a polyvinyl composition containing carboxyl and alcoholic hydroxyl groups.

B.P. 586,199. Application date: 20.7.44. Accepted: 11.3.47.

Improvements in or relating to the Production of Cellular Synthetic Resin Compositions. M. Goldstaub and W. H. Chapman. To: Semtex, Ltd., and Dunlop Rubber Co., Ltd.

Production of cellular products from a composition containing a liquid hardenable resin (phenol-formaldehyde or urea formaldehyde), a hardening agent (hydrochloric acid), a surface active reagent (sulphonated castor oil) and silica gel, by foaming said composition by vaporizing and maintaining the foam until the resin has set.

B.P. 586,249. Application date: 8.12.44. Accepted: 12.3.47.

Improvements in or relating to Adhesive or other Coating Compositions comprising Solutions of Neoprene or in or relating to the Coating of Surfaces of Porous Materials with such Compositions. L. E. Puddefoot, W. H. Swire and A. Hardy. To: B.B. Chemical Co., Ltd.

B.P. 586,297. Application date: 6.10.44. Convention date (U.S.A.): 6.10.43. Accepted: 13.3.47.

Improvements in or relating to the Photopolymerization of Unsaturated Organic Compounds. To: E. I. Du Pont de Nemours and Co.

Photopolymerization of styrene in the presence of 0.01-1.0 per cent. of carboxymethyl N, N-dimethyldithiocarbamate by irradiation with light of a wave length between 2,800-4,000 Angstrom.

B.P. 586,386. Application date: 17.1.44. (Divided out of B.P. 586,158.) Accepted: 17.3.47.

Improved Apparatus for the Extrusion of Non-Metallic Plastic Material. J. L. Packer and H. McD. Steward. To: British Insulated Cables, Ltd.

Screw extruder for thermoplastic materials using H.F. heating.

B.P. 586,387. Application date: 17.1.44. Accepted: 17.3.47.

Improved Apparatus for the Extrusion of Non-Metallic Plastic Material. J. L. Packer and H. McD. Steward. To: British Insulated Cables, Ltd.

Screw extruder for thermoplastic materials using H.F. heating.

INDUSTRIAL DIAMOND INFORMATION BUREAU, originally established in 1943 by the Diamond Trading Co., Ltd., at 32-34, Holborn Viaduct, London, E.C.1, has been taken over by the Diamond Research Department of Industrial Distributors (1946), Ltd. The Bureau will continue to maintain a reference library on scientific and technical aspects of diamond, including patents.

The Microscopic Examination of Plastic Materials

VI.—Mouldings (Fillers)—(f) Fibrous Materials

By J. H. WREDDEN, F.R.M.S.
(Chief Chemist, Igranic Electric Co., Ltd.)

The author has so far examined the structure of the hemp fibre from the grosser points of view. He now deals with the finer microscopic details of the fabric of this fibre.

FROM the knowledge already gained, we know that the hemp fibre originates in the bast portion of the stem of the plant, and, as such, it must be composed of phloem tracheids, which are in turn composed of the familiar elongated tracheid cells, cemented end to end; thus, a single tracheid could be of great length, but only the thickness of one elemental cell.

It is proposed, first, to examine the hemp fibre when reduced to its elements, commencing with the fibres in transverse section. We see in Fig. 181 some fibres of Manila hemp cut in this direction, magnification 75 diameters. This fibre is obtained from the leaf stalks of *Musa textilis*, a native of the Philippine Islands. It will be seen from the section that the fibre composes almost the entire phloem of the vascular bundle from which it is extracted. The individual tracheids will be seen to be comparatively thin-walled, and each element possesses a somewhat large lumen or bore, while in general the tracheids will be seen to form large bundles containing numerous elements; this, of course, is responsible for the characteristically large fibres so typical of Manila hemp.

A better idea of the general shape of these fibre elements, in transverse section, is obtained from Fig. 182, this being a portion of the same preparation at magnification 190 diameters, and from which we see that they are generally of irregular shape, being somewhat flattened, although the lumen is by no means obliterated by this flattening. At "A" are shown some elements which have undergone considerable flattening, while adjacent to them is the group of elements at "B," which shows little, if any, signs of flattening.

It will be seen that there is a fairly wide variation in the cross sectional area of the bore, which, in the case of an element such as this, would appear to require perfect consistency in the ideal, so that particle impregnation may be completed with the minimum degree of hindrance, such as would be experienced in a particle containing elements whose bores were of different dimensions, as shown by the fibre under discussion. In spite of this uneven cross section, it is highly probable that a filler composed of very short lengths (about 1/32 in.) of this fibre would show some remarkable results

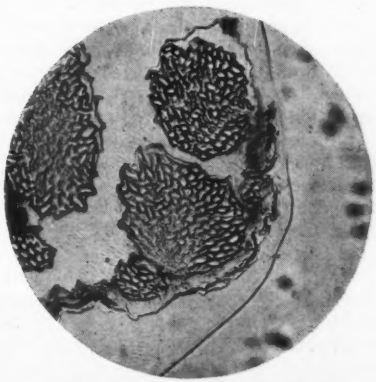


Fig. 181.—Manila hemp: transverse section. Mag. 75 diameters.

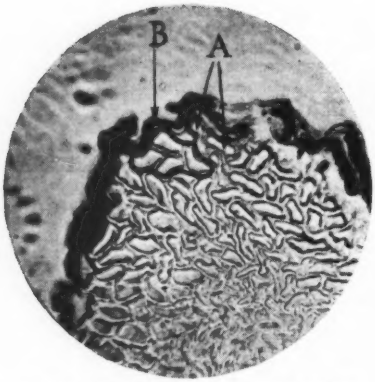


Fig. 182.—Manila hemp : transverse section. Mag. 190 diameters.

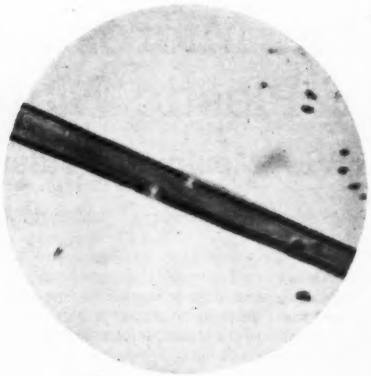


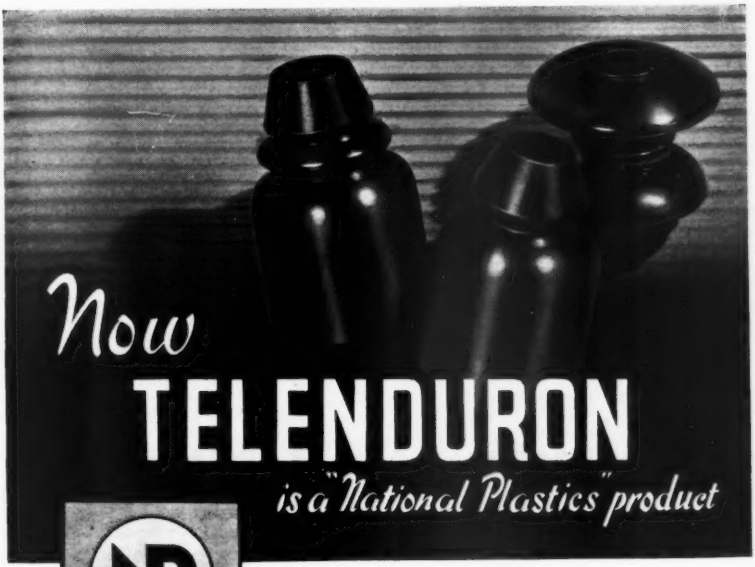
Fig. 183.—Manila hemp : fibre element. Mag. 375 diameters.

in finished mouldings, at least in so far as mechanical strength is concerned, due to the great strength inherent in the fibre and the fact that it would, in all probability, be much easier to impregnate the filler particle than would be the case with the wood flour particle, because of the comparatively large cross section of the bore of the fibre element.

In this way a filler of good quality is capable of being produced, providing that the particle length could be kept reasonably constant; however, this would involve some means by which the fibre could be cut to a predetermined length, which would result in a material somewhat akin to wood flour, although it could not, strictly speaking, be termed a "flour," as there would be no grinding operation required to produce it. Also, if produced by cutting, the resultant product may be expected to possess strong tendencies towards a low variability index and constant L.B. ratio, which, as we have already seen, are very desirable characteristics in any filler.

However, it would appear possible to produce a filler composed entirely of fibre elements, for the fibres readily break down into their constituent elements by treatment with alkaline solution. As a result of this treatment, Manila hemp produces fibre elements varying in length from 3 to 12 m/m. and about 16 to 12 μ in diameter; thus it will be seen that the average length to breadth ratio is in the region of 250 to 1. The fibre elements are smooth and possess a very even bore, this, of course, indicating an even wall thickness as seen in Fig. 183, which shows one element of Manila hemp at 375 diameters. The bore is seen to be very regular, although tapering slightly towards one end; this is due to the fact that the fibre elements are unicellular bodies, possessing pointed ends, hence the bore tapers down from the centre of the element towards the ends, and in this way a slight increase in wall thickness is seen to exist in the same direction.

On considering the utility of this type of element, as a filler particle, it becomes apparent that the general morphology of the tracheid shows it to consist of a tube with closed ends, and although the fibre is slightly lignified (as shown by the development of a yellow coloration when treated with aniline sulphate) it must be remembered that in the broken-down condition, after alkaline treatment, the lignin is, to all intents and purposes, removed; and we are therefore left with a unit consisting of almost pure cellulose, in which condition it is reasonable to suppose that a weakening of the general structure of the unit takes place.



The mark of a National Plastics Company

"Telenduron," the bitumen-asbestos moulding compound, and the wide range of insulators and battery boxes made from it, now appears under the National Plastics mark.

It has long held a prominent place in the plastics industry, not only at home but also under rigorous climatic conditions in many other parts of the world. It is not possible to hold a stock of "Telenduron" finished products because they are in great demand, but the material is relatively in good supply and many articles made from it can be supplied from stock moulds.

Enquiries both for home trade and for export should be addressed to the makers, British Moulded Plastics Ltd., at Walthamstow.

BRITISH MOULDED PLASTICS LTD
AVENUE WORKS • WALTHAMSTOW AVENUE • LONDON • E 4

WHEN YOU MEAN BUSINESS

FLY BEA

Get to the point more quickly—by air. The services of BEA bring a personal touch into business relations with countries across the Channel and stimulate closer, more realistic contact between the manufacturer and his continental markets. Firms which speed their representatives, samples and tenders by air appreciate that time is money, and that flying saves both

Regular services between London and Amsterdam, Ankara, Athens, Berlin, Bordeaux, Brussels, Copenhagen, Frankfurt, Geneva, Gibraltar, Gothenburg, Hamburg, Helsinki, Istanbul, Lisbon, Madrid, Marseilles, Oslo, Paris, Prague, Rome, Stavanger, Stockholm and Vienna

BEA

THE KEY TO EUROPE

British European Airways **Reservations and enquiries from principal travel agents and from Airways Terminal Telephone Victoria 2323 Headquarters Northolt Middlesex**

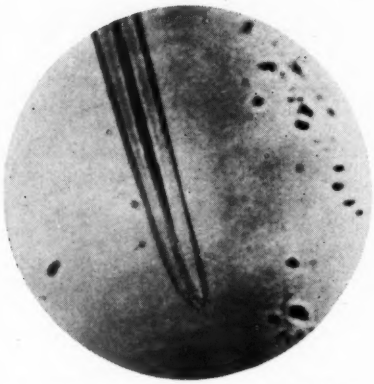


Fig. 184. — Manila hemp: tip of fibre element. Mag. 375 diameters.

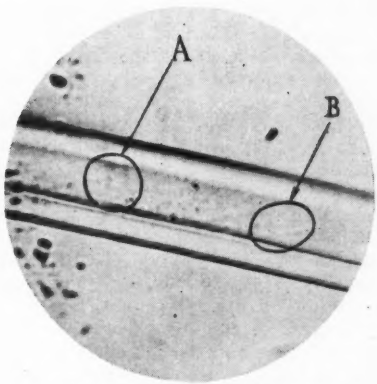


Fig. 185. — Manila hemp: fibre element, showing pitting. Mag. 600 diameters.

In view of this, it would seem that the choice of a material such as this should be given careful consideration, as there would appear to be distinct possibilities of the obvious advantages being negated by disadvantages, not at first so clearly indicated. However, the reduced fibre would appear to offer considerable utility as a filler, where great mechanical strength is not so important, because its fine texture should result in the production of excellent finishes, and, furthermore, the large L.B. ratio would put it into a similar class with cotton linters; in fact, it is highly probable that a fibre tracheid filler would compare very favourably with this latter, in spite of the particle being a sealed tube. The end of one such element is shown in Fig. 184, magnification 375 diameters, from which it will be seen that the wall thickness varies only slightly from the centre of the tracheid to the ends.

It has been pointed out in the foregoing discussion that, owing to the fibre element consisting of a closed tube, there would naturally be some difficulty in filling the bore with resin when impregnating the material in the course of its incorporation into a moulding powder. In view of the importance of this, let us examine the structure of this fibre somewhat more closely.

In Fig. 185 we see one of these tracheids at a magnification of 600 diameters. This illustration demonstrates the presence of certain structures in the cellulose wall which are of great interest and have a direct bearing on the problem in hand. Thus, at "A" is shown a group of what would appear to be minute pits in the wall of the tracheid. The existence of these pits has been noticed by a number of workers, and it has been more or less established that they are peculiar to fibres from bast tissue; that is to say, those bast elements located in the stem tissue of plants, and as the Manila hemp fibre is obtained from the stem and leaf stalks of the plant, the presence of these pits is not unexpected.

In general, the pits are seen to be very numerous, and in this respect one conclusion which may be arrived at is that the structure might now be considered to resemble a tube made of perforated material. However, as the presence of these pits is extremely difficult to demonstrate in the first place, and as it does not appear to be possible to show their existence in an optical section of the wall of the tracheids, the fact of their existence as perforations of the wall should be regarded with extreme caution; in fact, there does not seem to be any evidence that they exist as pits of appreciable

depth, if at all. On the other hand, it is quite possible that they do exist as perforations, but means of showing them in optical section has not as yet been discovered.

There is no doubt, however, that if such is the structure of these tracheids, then we have at hand an extremely useful material for filling purposes, by means of which mouldings of an homogeniety of structure approaching the ideal concept may be produced with relative ease, by virtue of the facility with which complete impregnation may be carried out.

Another interesting structure in this element is seen in the form of striations in the wall, as shown at " B " (Fig. 185). These would appear to take the form of a spiral along the length of the unit; they are therefore of interest from the point of view of the structure of the wall material. Much work has been done in the past on the structure of cellulose fibres. This examination has been carried out mainly by means of the use of swelling agents (such as sulphuric acid, zinc chloride, etc.), which have the effect of separating the fibres and so bringing them within the resolving capabilities of the optical microscope, although in some cases this spiral fibrillar structure may be observed with little or no swelling, as in the example under consideration.

A clearer picture of this structure is shown in Fig. 186, where we see the same fibre at 600 diameters, so photographed that the focal plane coincides with the top of the fibre element. Here, the spiral nature of this structure is easily seen; thus at " A " we have what appears to be a " pinch " like structure, or constriction of the surface of the element, orientated at an appreciable angle to the long axis of the unit, while at " B " is seen one of a number of striations indicating the spiral nature in general. These striæ are below the level of the " A " structure, and hence are not so clearly distinguished; they probably lie about midway through the thickness of the wall. It might be argued that as the markings are seen to lie only in the one direction, they might possibly be due to an artefact, but this is easily

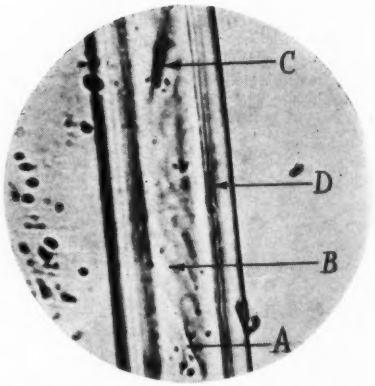
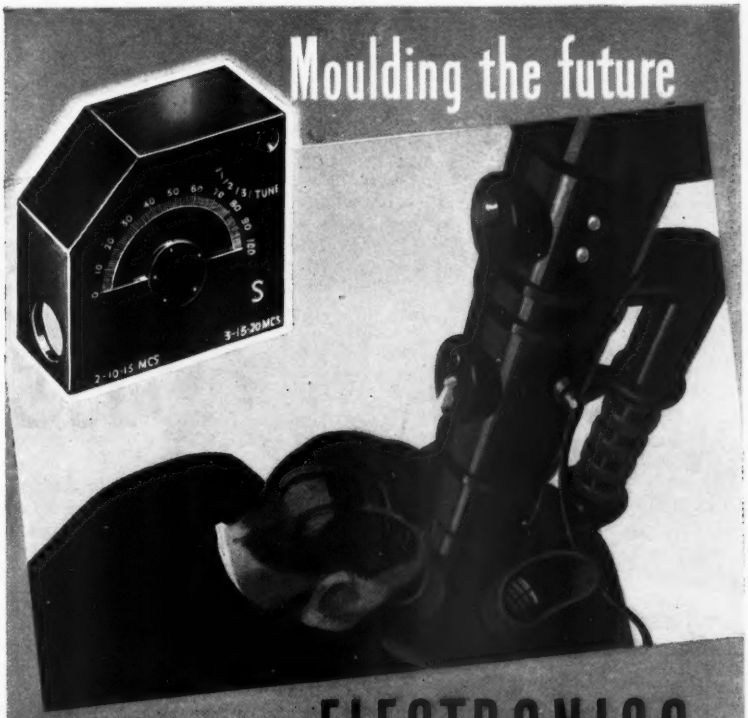


Fig. 186. — Manila hemp, showing spiral structure. Mag. 600 diameters.

refuted by an examination of the lower portion of the element when they are seen to lie in the opposite direction, similar to " C," which is a surface constriction, as at " A," but located on the under side of the fibre and visible by virtue of its being more prominent than internal markings. It is generally thought, and there is some evidence to support the view, that the cellulose molecule chains lie in a direction parallel to the fibrillar structure, in fact, it is highly probable that the spiral is capable of being demonstrated by virtue of molecular orientation in this direction; in other words, what we see is the resultant effect of a spiral orientation of the miscelles.

How this comes about, or the reason for it, is still apparently unestablished, although it is possible that this structure might be developed as a result of stretching during growth, in the same way that spiral lignification is produced. This being so, it is easy to see how the fibre so produced develops its great strength, and, furthermore, the highly stressed condition of the cellulose would produce strong birefringence effects. A similar condition, of course, exists in the highly orientated synthetic cellulose fibres, which all show strong birefringence.

Another interesting feature of the structure of this fibre is the laminated



in ELECTRONICS

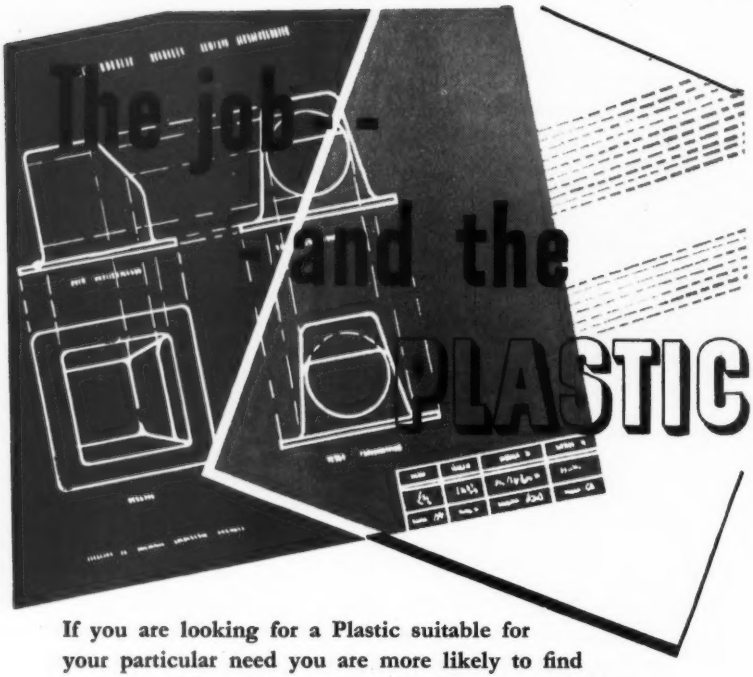
Mouldings for industry. Moulding Powders. Resins solid, powdered or in solution, for all classes of bonding work. Insulating varnishes. Cements and lacquers. Anti-friction resins for fabric bearings. Casting resins. Capping cements. Paint resins. Filling compounds. Sealing fluids.

PLASTICS ELO PRODUCTS

The Hallmark of Modern Plastics

Full information and data from Sales Development Department

BIRKBYS LTD., LIVERSEDGE, YORKSHIRE



If you are looking for a Plastic suitable for your particular need you are more likely to find it in the 'Celanese' range of cellulose acetate Plastics. Recent developments and improvements in the cellulosics are increasing the scope of their usefulness. The 'Celanese' technical staff with experience gained from research and experiment are at your disposal.

'Celanese' TRADE MARK Plastics

'Celanese' plastics are marketed under various trade marks including the following: 'CELASTOID' (Sheets, Rods, Tubes, Sections, Moulding Powders), 'CLARIFOIL' (Film), 'CINEMOID' (Special non-flam Sheeting).

BRITISH CELANESE LTD., Celanese House, Hanover Square, London, W.1

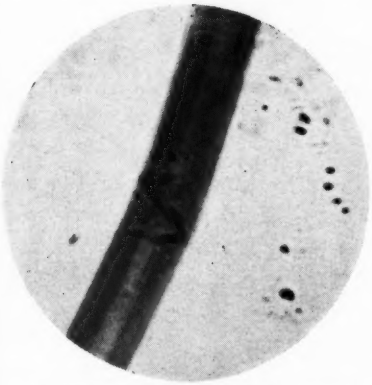


Fig. 187.—Manila hemp: fibre element showing marking. Mag. 560 diameters.

appearance of the wall shown at "D," which is to be expected, as it has long been known that periodic growth rings occur in these tissues, and are an indication of the periods of growth and no growth. In the case of the cotton hair, they represent steady growth, but whether this is the case with stem tissue elements is not established; it does, however, show that the cellulosic wall of these elements is far from being structureless. So that it will be seen that, when considering the structural details in relation to the strength of the fibre, more than one factor has to be taken into consideration.

Previous mention has been made of various types of cross markings in the hemp fibre. (See "Plastics," May, 1947.) These are curious structures, inasmuch as their mode of development has not yet been established. Höhnel[1] expressed it as his opinion (as long ago as 1884) that these markings were developed as the result of unequal pressure in the radial tissues of the plant, which, of course, points to them being of physiological origin. On the other hand, Schwendener[2] considers their origin to be due to artificial influences during the process of preparation, such as boiling in 10 per cent. sodium hydroxide solution followed by mechanical disintegration; he gives as his reason for his conclusions that fibres obtained by simple retting in water, show these markings only sparingly. However, it is somewhat difficult to reconcile Schwendener's views with actual fact; for example, the dislocation mark illustrated in Figs. 179 and 180 (May issue) appear in a complete fibre, made up of the usual elements, which has been water retted, and, furthermore, there was abundant evidence of these and similar structures in the sample examined.

It is also apparent when examining the fibre elements that the marks are not a result in the agglomerate, but rather are they the cumulative result of structures appearing in the basic elements. In Fig. 187, we see an element photographed at a magnification of 560 diameters, which clearly shows one of these so-called dislocation marks in the structure of the wall. This is of particular interest, inasmuch as it has obviously taken a spiral form, and, as such, could quite possibly have been developed from the "pinched" structure shown in Fig. 186. In other words, a set of circumstances could have arisen during the development of the element which caused an unusual local intensification of stresses at this point, so that the "pinch" was developed to a greater extent; it also appears to be influenced by the spiral miscelle structure, and it is not difficult to visualize the greatly elongated pinch taking the form of a spiral as shown.

In general, the spiral molecular structure of these fibre elements may be seen to influence the structure of the markings to a large extent. This is particularly well shown by a study of the tracheids under conditions of polarized light, as shown in Fig. 188, of a fibre unit with the system crossed, magnification 285 diameters. This unit is seen to be well marked at intervals along its length. The markings do not appear to be spiralized in themselves, but they are all set at an angle to the long axis of the fibre, so that the general impression given is that they are portions of a spiral not visible as a whole. When these markings occur under these conditions, the unit and, of course, the fibre, appear as if jointed at these points.

Fig. 188.—Manila hemp : showing cross markings, viewed under polarized light, system crossed. Mag. 285 diameters.

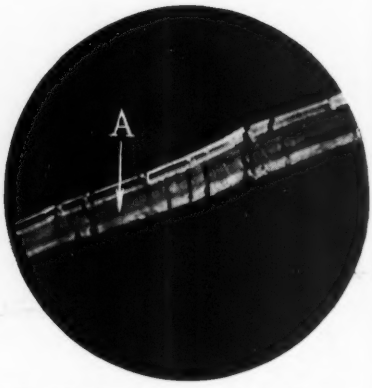


Fig. 189.—Jugo Slav hemp : single filament, viewed under polarized light, system crossed. Mag. 310 diameters.

The significant point with regard to these markings in the units is that they are in the same position in elements composing a given fibre, with the result that the fibre itself exhibits a similar arrangement of marks.

As has been stated previously, the actual cause of these markings is still unexplained, but it is worthy of note that as these fibres exhibit unmistakable signs of slight general lignification, it is possible that the markings are indications of areas of lignified thickening, in much the same manner as the similar structures produced in the tracheids and vessels of the xylem tissue of wood. On the other hand, it is equally probable that they are areas where longitudinal compression or elongation of the wall has occurred, due to movement of the plant by external mechanical forces, which have been fixed in situ by subsequent growth.

Various types of hemp from different sources are, of course, grown under different conditions, and, therefore, may be expected to produce somewhat different results under the microscope. This is well shown in Fig. 189, where we see an element of Jugo Slav hemp under a crossed polarizing system, magnification 310 diameters. It will be seen that this element is more strongly and profusely marked than is the case with Manila hemp; thus the lumen is easily seen at "A" to be somewhat less regular than that in the previous type. The markings are seen to be more in evidence apart from being more numerous; the net effect of this is to show up more clearly the general spiral arrangement; as marks at equal and opposite angles are to be seen here and there on the under surface of the fibre element, at the same time a few of the wall pits are also to be seen, as is the curious effect of the element having been divided into a number of segments due to the cross markings not polarizing so strongly as the "unstressed" portions of the wall.

The transverse marks in the hemp fibre frequently occur in bunches spaced irregularly along the length of the element. Here, again, their structure would lead one to suppose that they arise by virtue of the development of local areas of stress during the development of the element, the subsequent growth and lignification holding them in place, for when examined under polarized light at relatively high magnifications, such as the unit shown in Fig. 190, the area which polarizes most strongly is seen to consist of a fairly close spiral band, and in this particular instance there appears to be

Fig. 190.—Manila hemp: fibre element, viewed under polarized light to show structure of cross markings. Mag. 600 diameters.

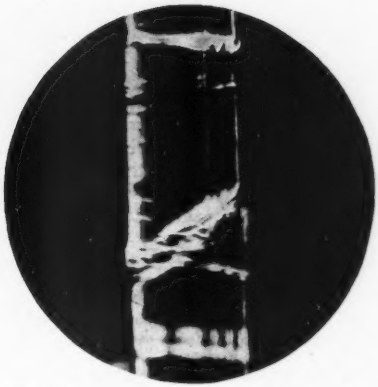


Fig. 191.—Manila hemp: dislocation mark, viewed under polarized light, system crossed. Mag. 600 diameters.

more than one such area. Assuming that these bands are either thickened portions of the wall, or highly stressed areas in the structure, then it will be seen that the tracheid, in the first instance, and the complete fibre, in the second, would be equipped with a self-generated spring built into the structure of the material of which it is composed, and in this way the great strength of these fibres may be accounted for in some measure. Although it must be remembered that the spiral fibrillar structure (which also exists in fibres which show no transverse markings) of the cellulose wall itself is probably the main contributor to the strength of the material, and, furthermore, these fibrillar structures do not necessarily proceed in the same direction; thus Preston[3] points out that the spiral fibrils in flax are anti-clockwise, while those for hemp are clockwise, and he states further that in the case of cotton there may be frequent changes. Preston also quotes the opinions of Ludke[4] and Sisido[5] that the majority of cellulosic fibres of natural origin appear to be built up of concentric shells of spiral fibrillæ, matters being further complicated by the fact that the fibrils in successive shells do not necessarily proceed in the same direction.

Previous mention has been made of the so-called dislocation marks to be seen in fibres, and one such has been illustrated. (See "Plastics," May, 1947, page 268, Figs. 179 and 180.) In the same manner as the transverse markings have been shown to originate in the fibre elements, so may these dislocations be shown to exist through the structure of the fibre down to the element. In Fig. 191 we see a similar mark existing in an element of Manila hemp, photographed under polarized light at a magnification of 600 diameters. The general appearance of this structure seems to suggest that a portion of the fibre element has been pushed to one side, so that its long axis is no longer coincident with, but parallel to, that of the element. Preston (loc. cit.) gives it as his opinion that the appearance of this structure is probably due to the existence of a "crystal" slip plane, although, as he states, this is by no means a completely satisfactory explanation. Due to the lack of more definite information regarding the manner in which these structures are produced in the first instance, we must of necessity indulge in assumptions as to their actual character; however, they do exist, and whether or not they have any great influence on the characteristics of the fibre still remains to be established. The fact of greatest importance concern-

ing the use of these fibres as filling materials is, of course, the superior mechanical strength. However, the examination of the minute structure has been of use in conveying some idea of the nature of the material, and from this it is possible to visualize its behaviour as a filler, and we shall see that other fibres offer greater or fewer possibilities in this direction as the examination proceeds.

(To be continued.)

REFERENCES

(1) *Uber den Einfluss des Rindenbruckes auf die Beschaffenheid der Bastfasern der Dicotylon Prengsheims, Jahrb, Wiss. Bot.*, 1884, **15**, 311, 316. (2) *Uber die "Verschiebungen der Bastfasern in Sinne,"* *v. Höhnels, ber Deutch Bot. Gesell.*, 1894, **19**, 239. (3) *Preston, "Modern Textile Microscopy" (Emmot and Co.)* 197. (4) *M. Ludke, "Mell Textilber," (1929)* **10**, 445—448. (5) *K. Sisido, "J. Cell. Inst." (Tokio), (1930)*, **6**, 148.

GAUGE AND TOOL MAKERS' ASSOCIATION.—Following the recent annual general meeting of the Association, Officers for 1947-48 were elected as follow: — F. W. Halliwell, M.I.Mech.E., M.I.P.E., president; H. H. Harley, immediate past president; H. S. Holden, chairman; A. L. Dennison, vice-chairman; R. Kirchner, honorary treasurer; Gilbert T. Beach, secretary; J. A. Spencer, assistant secretary. The offices of the Association are at Standbrook House, Old Bond Street, London, W.1.

Index to Advertisers

	Page
Almex, Ltd.	lvi
Ashdowns, Ltd.	iv
Automobile Metalcraft Co.	xlviii
Bakelite, Ltd.	Front Cover
Barber & Duffy, Ltd.	lxii
Baynes, Charles, Ltd.	lviii
B.G. (London), Ltd.	xxviii
Birkby's, Ltd.	xlv
Blackfriars Engineering Co., Ltd.	xlix
British Celanese, Ltd.	xlvi
British European Airways	xliv
British Gas Council	viii
British Industrial Plastics, Ltd.	xlvii
British Institute of Plastics Technology	lxi
British Moulded Plastics, Ltd.	xliii
British Mouldex Rubber Co., Ltd.	xxv
BX Plastics, Ltd.	Inside Front Cover
Byson Appliance Co., Ltd.	lxii
Carpenter, J. H., & Son (London), Ltd.	lxii
Catalin, Ltd.	xi
Cellon, Ltd.	v
Cohen, George, Sons & Co., Ltd.	vi
Cole, R. H., & Co., Ltd.	xxxvii
Collis, J., & Sons, Ltd.	xiv
Cornercroft (Plastics), Ltd.	xxxiv
Courtaulds, Ltd.	iii
Crystalate, Ltd.	xxviii
Davey, Paxman & Co., Ltd.	xxxiii
Derwent Plastics, Ltd.	xvii
Desoutter Bros., Ltd.	xxi
Dohm, Ltd.	lix
Don Optical Co., The	lx
Dunbee, Ltd.	xlviii
Duraplex (Plastics), Ltd.	lv
Duratube & Wire, Ltd.	xxiv
Erinoid, Ltd.	Back Cover
Ether, Ltd.	lviii
Evans, Frederick W., Ltd.	lxii
Ferodo, Ltd.	iii
Firth Brown Tools, Ltd.	xv
Firth-Vickers Stainless Steels, Ltd.	xxxiv
Fisher & Ludlow, Ltd.	liv
Fraser, Andrew, Ltd.	xxxv
Frenkel's Machines (Gt. Britain), Ltd.	x
Gardner, Wm., & Sons (Gloucester), Ltd.	xl
General Electric Co., Ltd., The	xxix
G.R.L. Plastics, Ltd.	xxxii
Haigh, John, & Co., Ltd.	lvi
Hornflowa, Ltd.	xxvi
Imperial Chemical Industries, Ltd.	xxxix
International Combustion, Ltd.	xxvii
Jones, Samuel, & Co., Ltd.	xxiv
Kayser, Ellison, & Co., Ltd.	xxiii
Kent Mouldings	lv
Kenure, J. F., Ltd.	lxii
Lavino (London), Ltd.	liii
Law, F. W., & Sons, Ltd.	lviii
Londex, Ltd.	lviii
Martin, J., & Sons, Ltd.	lvi
M.C.L. and Repetition, Ltd.	lvi
McArd, Robert, & Co., Ltd.	xx
Micanite & Insulators, The, Co., Ltd.	xxxviii
Midland Industries, Ltd.	l
Ministry of Fuel and Power	ii
Ministry of Labour	xviii
Ministry of Supply	lxiii
Monsanto Chemicals, Ltd.	xxxvi
Moulded Products, Ltd.	l
National Savings	lxiii
New London Manufacturing Co., Ltd.	lvi
Page, W., & Sons	lx
Peace, Harold E., & Co., Ltd.	liv
Plastics Specialities, Ltd.	lii
Potts Engineers, Ltd.	lvii
Power Flexible Tubing Co., Ltd., The	xlix
Proved & Producing Properties, Ltd.	xlviii
Reed Bros. (Engineering), Ltd.	xlviii
Reliance Trading Co.	liv
Renold & Coventry Chain Co., Ltd., The	lii
Rootes Mouldings, Ltd.	lvii
Rubber Improvement, Ltd.	Inside Back Cover
Rubber Trading Co. (Kent), Ltd. The	lviii
Runbaken Electrical Products, Ltd.	lx
Schori Metallising Process, Ltd.	xxii
Sellotape	lix
Shannon, Ltd., The	xxx
Simco Plastics	xlii
Static Condenser Co., Ltd., The	lxi
Steele & Cowlishaw, Ltd.	lx
Sunvic Controls, Ltd.	li
Synchronome Co., Ltd., The	lxi
Tenaplas, Ltd.	xxxi
Terry, Herbert, & Sons, Ltd.	vii
Thermo-Plastics, Ltd.	xiii
Thompson & Norris, Ltd.	xxii
Toolmakers & Designs (Coventry), Ltd.	lxii
Trapinex, Ltd.	xli
Tullis Russell & Co., Ltd.	xvi
Turner Brothers Asbestos Co., Ltd.	xxx
Turner Mfg. Co., Ltd.	xix
Tyne Truck & Trolley Co., Ltd.	lx
U.K. Plastics, Ltd.	lx
United Ebonite & Lorival, Ltd.	i
Universal Tools, Ltd.	xxxii
Utilex, Ltd.	liii
Visco Engineering Co., Ltd.	li
Wallpaper Manufacturers, Ltd., The	lx
Wilkinson Rubber Linatex, Ltd.	xii

Leaves from a Moulder's Notebook

This is the seventh in a series of notes by the B.I.P. Development Department on the problems of the moulder and designer. B.I.P. will send a copy of previous notes on request and will welcome comments and enquiries.

Ribs

Ribs are incorporated in mouldings to give supporting strength where it is needed. They are a purely structural device, and as such are often a necessary evil, with a tendency to cause unsightly flow lines and shadows or warping of the unsupported areas. If the moulding is opaque and the surface to be supported relatively thick, quite large ribs can be employed in the design without harm, but a large and comparatively thin area sets a problem.

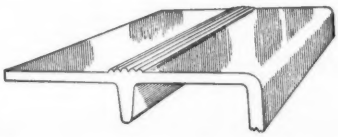


Fig. 1.
Ornamental fluting may disguise flow marks and shadows caused by ribs.

The difficulty can be partly overcome by the introduction of complementary lines of ornamental fluting or ribbing, as shown in Fig. 1. This will have the effect of disguising flow lines and shadows, and to some extent warping, though warping cannot be obviated by such means but can only be controlled by a proportionate increase in the thickness of the moulding. Fig. 2 illustrates a solution of this kind: it shows a section of a draining board, with complementary ribbing above the support ribs.

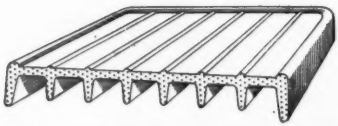


Fig. 2.
Section of draining board, showing complementary ribbing above the support ribs.

Where a very large area is concerned the combination of moderate thickness and correctly placed ribs can eliminate all but slight warping. To obtain complete elimination of warping might necessitate increasing the number of ribs or the thickness of the moulding to an extravagant degree, since too thin a moulding would warp between the ribs with age, if not initially. Fig. 3 shows a section of a butter slab, the upper surface of which needed to be free from fluting or ribbing; it illustrates the maximum proportion of area to thickness which in practice has given satisfactory results.

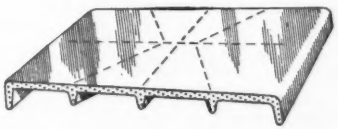


Fig. 3.
Section of butter slab of dimensions 17 in. square by 0.2 in. thick.

BRITISH INDUSTRIAL PLASTICS LTD.
1 ARGYLL STREET · LONDON · W.1
B·I·P GROUP

NEW OIL HYDRAULIC PUMPS

SEVERAL NEW swash plate type, variable delivery; 3 gallons per minute at one-ton pressure with pressure gauge: suitable for direct coupling.

REED BROTHERS (Engineering) LTD.

BEVIS MARKS HOUSE, LONDON, E.C.3

'Phone: AVEnue 1677/8. 'Grams: REPLANT, ALD, LONDON.

FIRST GRADE

UREA COMPRESSION MOULDING POWDER

Quick Delivery
Reasonable Price
Assorted Colours

Apply for further details to

DUNBEE LIMITED

10, Union Court, Wormwood Street LONDON, E.C.2

Telephone - - - LONdon Wall 2298/9

SHEET METAL

FABRICATED COMPONENT PARTS

IN ALL TYPES SHEET METAL TO YOUR SPECIFICATIONS

also

INDUSTRIAL ELECTRICAL HEATING ELEMENTS

AUTOMOBILE METALCRAFT CO.
DEPOT ROAD, EPSOM 3366

Octopus

ELECTRIC WIRING SYSTEM for FACTORIES, OFFICES AND HOUSES

APPLICABLE TO ANY SYSTEM OF BUILDING

Write for illustrated brochure to

PROVED AND PRODUCING PROPERTIES Ltd.
5, Cheapside, London, E.C.2, or
HARTLEY ELECTROMOTIVES, LTD.,
57, Victoria Street, London, S.W.1

METALFLEX HOSE

ALL METALLIC

IS THE IDEAL FLEXIBLE TUBING FOR

PLASTIC PRESSES

IT IS MADE IN COPPER-BRONZE OR STAINLESS STEEL

BY

THE POWER FLEXIBLE TUBING CO. LTD.

DERBY WORKS, FINSBURY PARK, LONDON, N.4

FOR

GRINDING PLASTICS

USE

The MASSON ROTARY CUTTER

The Masson Rotary Cutter reduces all kinds of Plastic materials and synthetic rubber to uniform granules with freedom from dust. Any degree of granulation obtainable. LOW H.P. HIGH OUTPUT.

BLACKFRIARS ENGINEERING COMPANY LTD.

BLACKFRIARS HOUSE · NEW BRIDGE STREET · LONDON · E.C.4 · Central 6383

AS-AD.

MOULDED PRODUCTS LTD

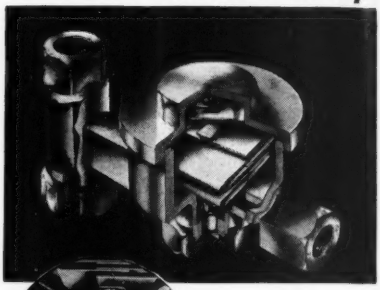
Pioneers in the Plastic Field, there is no class of moulding which Moulded Products Ltd. cannot undertake and after years of practical experience an organisation of designers, research workers and skilled technicians has been established which is superbly equipped to meet the specialised needs of manufacturers who require plastic parts or accessories of the highest quality finish within precision limits at economically competitive prices.

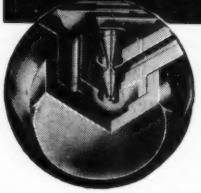
Send us your enquiries

A Technical Representative is available to discuss moulding problems at your own premises, if desired.

MOULDED PRODUCTS LTD.,
CHESTER ROAD, TYBURN, BIRMINGHAM

The amazing MIL *steam trap*





gives you these

positive advantages

SAVES FUEL · GIVES HIGHEST EFFICIENCY · INCREASES PERFORMANCE ELIMINATES TROUBLE · REDUCES COSTS. Hundreds of steam users, from jam manufacturers, canners, laundries to hospitals have proved over the last twelve months by exhaustive tests that the MIL Steam Trap is suitable for practically every job throughout a steam system. Tests have shown that because of the unique construction of MIL Traps stoppages are practically non-existent and apparatus works far more efficiently. In these days of fuel shortages it is essential that every pound of steam be used to the utmost. We believe that in the MIL Steam Trap we have the answer and invite manufacturers to write for full technical data.

MIL STEAM TRAPS *for all types of steam apparatus*

PIN THIS COUPON TO YOUR NOTE-HEADING & MAIL TO-DAY

TYPES OF EQUIPMENT USED.....

119

MIDLAND INDUSTRIES LTD., STEAM TRAP DIV., WOLVERHAMPTON TEL. 23901
MI/5 *S P.O.'C*

Dust Collection by VISCO

If dust is produced in the manufacture of your products we can show how this dust can be collected with advantage. How what is now a nuisance and a waste of good material can, in many cases, be converted into a profit.

We make Collectors for recovering resins and other materials used in the manufacture of plastics, cement, soap, flour, coffee, milk, chemicals, coal, and other materials in powder or fibrous form. 'Phone or write for particulars.

Ring Croydon 4181

VISCO ENGINEERING CO. LTD., STAFFORD ROAD, CROYDON

Is YOUR VOLTAGE all over the place?

Why not make your process heaters independent of voltage fluctuations?

The Energy Regulator maintains constant input to heaters despite normal or abnormal variations of voltage.

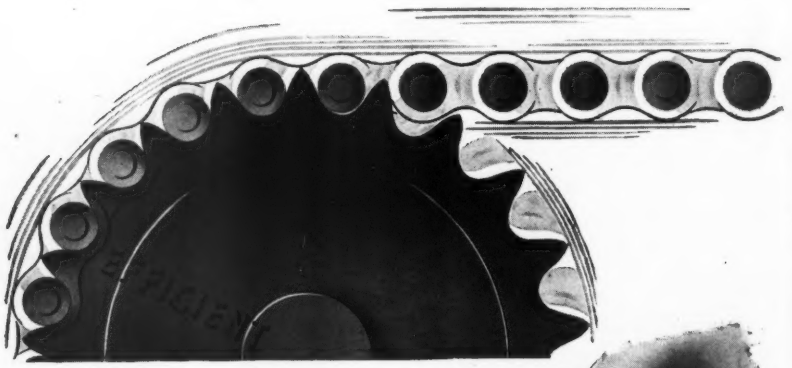
Prevent spoilt batches by fitting Energy Regulators in place of control resistances. The Type ER.3 unit controls up to 3.5 kW. at 230 V. A.C. or D.C.

Full details in publications R.12/51 and ER.10/51. WRITE NOW!

SUNVIC CONTROLS LTD.
Stanhope House, Kean Street, London, W.C.2

SUNVIC

TAS/SC167



POWER TRANSMISSION

by RENOLD

Transmission and Conveying Chains, Wheels and Accessories for all mechanical purposes

R&CC THE RENOLD & COVENTRY CHAIN CO. LTD. · MANCHESTER · ENGLAND

moulding powders

POLYSTYRENE
ETHYL CELLULOSE
CELLULOSE ACETATE
UREA FORMALDEHYDE
MELAMINE FORMALDEHYDE
PHENOL FORMALDEHYDE

We can offer early shipment from U.S.A. Delivery c.i.f. U.K. port. Dollar payment against irrevocable letter of credit in New York. Import Licences obtainable if finished goods intended for export or essential services.

Enquiries promptly attended to:—

PLASTIC SPECIALITIES LTD.
9, Belgrave Road, S.W.1
Telephone - - - - - VICtoria 6071/2
Telegrams - - "PLASTIAL SOWEST," London

Courtaulds
LIMITED
MOULDING POWDERS
SHEETING
TUBING
FILM
MADE FROM
CELLULOSE ACETATE
REGISTERED TRADE MARK

Plastics Division
Foleshill Road, Coventry. *Telephone: Coventry 88771*

UTILEX

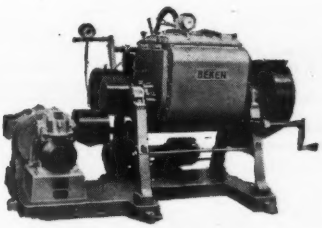
UTILEX

T RANSPARENT CELLULOSE ACETATE.
I NSULATING.
L IGHT.
E XCEPTIONAL IN CLARITY.
X CELLENT IN QUALITY

SHEETS, FILMS, MOULDING POWDER AND RIGID TRANSPARENT CONTAINERS.

UTILEX LIMITED,
MILL STREET, KINGSTON-ON-THAMES.
Telephone: KINGSTON 1660.

"No stirring tale, this!"



The story of the BEKEN "DUPLEX" Mixer tells of that rare achievement . . . the perfect mix! No longer is it necessary to be content with the customary glorified "stir"; the scientifically designed intermeshing blades of the BEKEN achieve a perfect mix, with the correct proportions of the ingredients . . . however diverse . . . maintained throughout. And it is all done in less time and at lower power cost! There is a BEKEN Mixer to suit every process and any output. Write us on your own mixing problems, and we will tell you the type of machine to do your job better than ever before.

BEKEN DUPLEX MIXERS

Sole Distributors: **LAVINO (LONDON) LTD.** Tel (HAncery 6131)
103, KINGSWAY, LONDON, W.C.2.

Sole Makers: **E. HUNT & CO., LTD.**
RIPPLE ROAD, BARKING, ESSEX.

Wanted!

stocks, for cash

- We are cash buyers of merchandise of every description. Also Clearance Stocks, Discontinued Lines, Surplus Stocks; in fact, goods of all kinds can be disposed of through us, without delay, on the most favourable terms, and without trouble.
- Should you have anything for disposal, either now or at any future time, please send us samples, full particulars and price on a cash settlement basis.

For Sale

- Departmental Stores, Multiple Stores and Shopkeepers are advised that we hold stocks of all kinds of Moulded Plastic Goods, Moulded Glassware, Fancy Goods, Haberdashery, etc. Enquiries invited.

Reliance Trading Company

WHOLESALE WAREHOUSEMEN AND GENERAL MERCHANTS

13, New College Parade, Finchley Road, London, N.W.3

KEEP THINGS MOVING —

FLOWLINE **YOUR OUTPUT**

Whatever you are packaging, transporting, assembling or processing, remember it's "faster on a Flowline." The Flowline Standardised Conveyor System is mechanical handling in its simplest, most efficient, and most economical form. Write for FLOWLINE Handbook: Fisher & Ludlow Ltd., Gridway Division, Dept. 9, 110/111 Strand, London, W.C.2. 'Phone Temple Bar 2755.

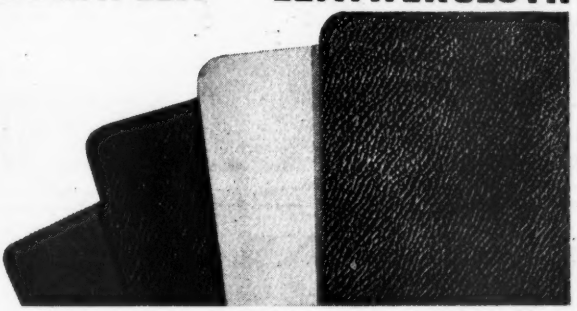
mouldings to precision limits

KENT, fine-limit, moulding is opening up a new medium for the precision engineer—wherever plastic components of high accuracy are demanded, there will you find the mouldings of KENT.

KENT MOULDINGS
PROPRIETORS: HOLSTEN BRANDES LIMITED
Footscray, Kent
Telephone: Footscray 3333

For mouldings that matter

Introducing ★
DURAPLEX P.V.C. LEATHERCLOTH



★ *Furniture* *Car Upholstery* *Baby Carriages* *Travelling Bags* *Footwear* *Office Equipment*

Here's the material you have been waiting for! Duraplex Leathercloth is 'scuff' proof, hard wearing and resistant to sea-water, oils, alkalis and most acids. Duraplex is impervious to oxidisation and it is also resistant to prolonged exposure to the weather. Duraplex cannot be soiled by oil or grease and stains are easily removed with warm soapy water. Duraplex is resistant against corrosive atmosphere and heat resistance is sufficiently adequate for all practical purposes. Duraplex abrasive resistance and flex life is superior to leather. Produced in a wide range of colours, going to the full depth of the material. Duraplex resistance to acid and corrosive chemicals make it ideal for industrial uses.
It cannot be soiled by oil or grease and its weight saving, longer wearing qualities minimise maintenance costs.

DURAPLEX (PLASTICS) LTD.
Burwood House, Caxton Street, London, S.W.1.
Telephone: WHitehall 2980 & 2989 Grams: POLYVYN, SOWEST, LONDON

HAIGH'S

for STEARINES

Supply shortages have compelled us to reduce appreciably the number of grades of Haigh's Stearines. Even so we maintain a range sufficient to meet your requirements, and you can always rely on a good product backed by helpful service.
Please let us know your usage, and we will submit samples.

JOHN HAIGH & CO. LTD.
CLAYFIELD OILWORKS
SLAITHWAITE - YORKS
Telephone : Slaithwaite 266/267

HOS.3

ALMEX LIMITED

78-82, EXCHANGE BUILDINGS,
STEPHENSON PLACE, BIRMINGHAM, 2.

MANCHESTER:
Rooms 42 & 43,
26, Corporation St.,
Manchester, 4.

LONDON:
Finsbury Pavement House,
120, Moorgate,
London, E.C.2.

We have available for immediate and forward deliveries large quantities of

CELLULOSE ACETATE
and **POLYSTYRENE**
moulding powders
all colours.
FOR USE ON EXPORT ORDERS ONLY

ACRYLICS and other powders obtainable if required.

P.V.C. and **POLYTHENE** available for the home market.

Let us have your enquiries, our representative will call on request.

CONTACTS

to the specific requirements of our customers

Makers of all types of repetition products from the bar in all metals

M·C·L AND REPETITION LTD
POOL LANE, LANGLEY, BIRMINGHAM

GRAINED MOULDING PLATES & ROLLERS IN LEATHER & OTHER GRAINS

J. MARTIN & SONS LTD.
17 TRAFALGAR ST BURY NEW RD MANCHESTER, 8.

METER DIALS AND SCALES

In order to cope with the demand for Meter Dials and Scales, we have extended our production facilities.
Your enquiries will receive our immediate and careful attention.
We are in a position to give prompt deliveries for urgent orders.

NEW LONDON MANUFACTURING & PLATING CO. LTD.
NEWLON WORKS - STANLAKE ROAD - LONDON - W.12
'Phone : SHEPHERD'S BUSH 2978.

SPECIALITY EQUIPMENT
FOR THE PLASTIC INDUSTRY
IS NOW IN
FULL PRODUCTION

POTTS
ENGINEERS TO THE PLASTIC INDUSTRY

IF YOU HAVE ANY PROBLEMS SEND THEM TO US

Early deliveries can now be quoted for the following: Die-casting Dies ★ Moulds for Plastic Materials ★ Steel Brands, Stamps, Nameplates, Metal Checks, Labels, etc. ★ Die-sinking and Engraving Work ★ Jigs and Fixtures—Special Machines, etc. All enquiries promptly dealt with!

POTTS ENGINEERS LTD.
FIRTH TERRACE, NEWTOWN, LEEDS
Telephone: LEEDS 23522

RM

SERVICE and DEPENDABILITY

Plastic Mouldings of all descriptions

ROOTES
Mouldings Ltd
SLOUGH, BUCKS Telephone: Slough 22349

ETHER

THERMO - COUPLE

SURFACE CONTACT PYROMETERS

Ether pyrometers used for measuring platen temperatures, automatically controlling injection moulding machine temperatures. A full range of instruments covers every requirement of the plastic industry.

ETHER LTD

TYBURN RD., ERDINGTON, B'HAM, 24

TELEPHONE: EAST 0276/7

WE BUY Scrap Plastic

We buy P.V.C. sheet off-cuts and cable strippings, Perspex, Polythene, Polystyrene, Cellulose Acetate, and other Thermoplastic scrap, *if free from metal.* All colours, sorted or unsorted.
Send details, giving approx. weight and description, and if possible enclose sample.

PHONE TEMPLE BAR 4038

THE **RUBBER TRADING CO. (KENT) LTD.**

Department B.P.,

12, Piazza Chambers, Covent Garden, London, W.C.2.

LONDEX PROCESS TIMERS

Synchronously driven and condenser charge/discharge Timers. Automatically self-resetting and hand-resetting types for controlling all kinds of industrial processes, plastic presses, chemical actions, welding, etc.

Ask for leaflets PT/PL

LONDEX LTD MANUFACTURERS OF RELAYS

207 ANERLEY ROAD LONDON S.E.20 SYDenham 6258-9

FOR RUBBER AND PLASTIC DIES OR MOULDS — AND SPECIAL MACHINES

the name is **LAW** *for the rapid execution of your* **ORDER**

F. W. LAW & Son Ltd.

CASTLE WORKS, MANCHESTER ROAD, ROCHDALE.

TELEPHONE: ROCHDALE 3002.

BRITAIN'S LEADING HACK-SAW BLADE—

DING-DONG

PRACTICALLY UNBREAKABLE

also

HIGH SPEED STEEL BLADES

Supplied by Tool Dealers, Engineers' Merchants, Mill Furnishers, etc.

Manufactured by :—

CHARLES BAYNES LTD.,

KNUZDEN BROOK, BLACKBURN.

Expand quicker...

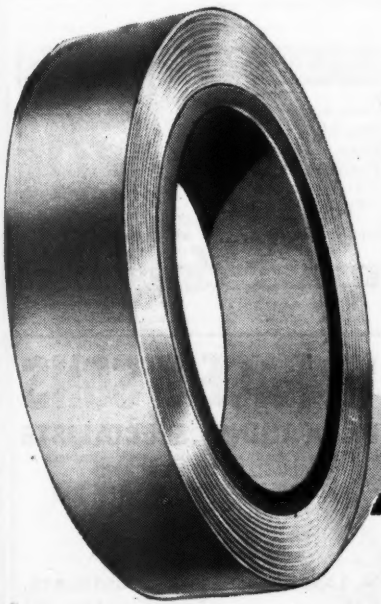
Use our plant and experience— Six factories for pulverising, mixing and grading of raw materials. We may introduce improved methods and materials.

DOHM LTD

167 VICTORIA ST.
LONDON, S.W.1

Telephone:
Victoria 1414/5/6
and Victoria 7913

SIX FACTORIES



clear or coloured
transparent or opaque
plain or printed

SELLOTAPE solves the trade moulder's difficult problem of counting and grouping an infinite variety of mouldings of different shapes and sizes for packing and despatch. No more bothersome discrepancies to aggravate customers and harass overworked staffs. Let us show you how SELLOTAPE can serve you in this and other ways . . . No obligation, of course.

GORDON & GOTCH LTD.

Dept. PL. 4, 75/79, Farringdon Street, London, E.C.4.

Sellotape

SELF-ADHESIVE CELLULOSE TAPE

Mica Lubricant and Filler . . .

N.S.S.A. Steam-water Ground Mica is a white paper filler and lubricating coating for other fillers to enhance their flow and thermal and electrical insulating properties.

Use as filler in paper to be coated with resin or varnish, then build up and press, roll or mould.

Coat ordinary mica powder with N.S.S.A. and then use as a filler for moulding powders to make them heat resisting and more reliable electrical insulators. Ideal filler for Plastic moulding powder and rubber.

Samples and Prices on Application

Technical Data

The Wall Paper Manufacturers Ltd.

MICA BRANCH

GRESHAM RD., OSMASTON RD., DERBY

Telegrams: MICABRANCH, DERBY

Telephone: DERBY 45761

STEEL-SHAW PEBBLE MILLS

For the grinding of all kinds of Powders, Chemicals, Minerals, Colours, Paints, Enamels, etc. Supplied lined with hard Porcelain, Silex or special linings, and can be insulated to suit particular classes of work.

Send for our free illustrated literature.

STEELE & COWLISHAW, LTD., *Engineers*

(Dept. No. 27). COOPER STREET, HANLEY, STOKE-ON-TRENT.

London Office: 329, High Holborn, W.C.1. Telephone: Holborn 6022.

Nearly ½ a Century's Experience in Grinding

TYNE TRUCK & TROLLEY CO. LTD

Hand Trucks of every Description

66-68 NORTHUMBERLAND ST. NEWCASTLE UPON TYNE

Electric MULTI-PURPOSE TOOL

"THE ENGINEER'S GOOD COMPANION"

This high-speed Tool Cuts, Grinds and Polishes. Has many Tool Room and Production uses.

Send for leaflet X32.

A HAND MACHINE TOOL

RUNBAKEN - MANCHESTER - 1

The Sole Proprietor

of the

DON OPTICAL COMPANY

THORNE :: :: DONCASTER

is now

MR. HORACE ALMOND

Father of the late Brian Almond

No other firm or individual has any financial interest in the Don Optical Company.

W. PAGE & SONS

PACKAGING SPECIALISTS

ALL SIZES OF NEW AND ONCE USED CARTONS SUPPLIED FROM STOCK

Please see our advertisement in classified columns for full details.

34, LANGSIDE CRESCENT, SOUTHGATE, N.14. *PALMERS GREEN 5087*

R.F. heating of plastics

A new addition to the RADYNE range of radio heaters, now available to industry

MODEL H40/A
Heating Capacity fully plasticise 3 lbs. per minute.
Oven Capacity 20 lbs.

MADE BY

radio heaters
WOKINGHAM · BERKS.
Tel.: WOKINGHAM 708

George Washington

COULD HAVE TOLD A LIE... if he had tried, but it is impossible for the Synchronome Electrical Impulse Clocks to do so. They do not depend on the Electricity Supply for their timekeeping or for their continuity of operation. They are installed all over the world and the Master Clock embodies the fundamental principles of the Free Pendulum installed at Greenwich Observatory by the Synchronome Company which has held the world's timekeeping record since 1925.
Supplied on rental terms including full maintenance or can be purchased outright. Write for full technical details of the SYNCHRONOME Clock and time recording systems for Factories, Offices, Public Institutions, Schools, etc.

but **SYNCHRONOME CLOCKS** *cannot!*

THE SYNCHRONOME CO., LTD.
ABBEY ELECTRIC CLOCK WORKS
WOODSIDE PLACE, MOUNT PLEASANT, ALPERTON, WEMBLEY.
Telephone: WEMbley 3643.

OPPORTUNITIES IN PLASTICS

A most informative handbook entitled "**OPPORTUNITIES IN PLASTICS**" is now available for distribution. This guide discusses in considerable detail the prospect of careers in all branches of the Plastics Industry—knowledge required, salaries, possibilities of promotion, and so on—and explains how you may prepare for these opportunities through our modern home-study courses.

We specialise in Plastics training and our courses are authoritative, up to date and comprehensive. The range of our tuition is wide, covering **Elementary Instruction in Basic Subjects, PLASTICS TECHNOLOGY,** coaching for the **CITY AND GUILDS EXAMINATIONS,** and specialised instruction in such specific branches of the industry as:—

Plastics Mould Design, Plastics in the Paint, Varnish and Lacquer Industries, Plastics Costing and Estimating, Plastics for the Aircraft Industry, Plastics for the Electrical Industry, Plastics for the Building Industry, Plastics in Sales Promotion, Plastics in Textiles, Designing in Plastics, Synthetic Rubber Technology, etc.

All courses are conducted under a guarantee of
"SATISFACTION OR REFUND OF FEE"

"**OPPORTUNITIES IN PLASTICS**" will be sent on request, free and without obligation. The book contains so much useful information and guidance that whatever your interest in plastics may be, you should make a point of writing for your copy at once.

BRITISH INSTITUTE OF PLASTICS TECHNOLOGY
2, Shakespeare House,
17, Stratford Place, London, W.1

TOOLMAKERS & DESIGNS (Coventry) LTD.

BRAYS LANE, COVENTRY. Telephone: COVENTRY 4051/2.

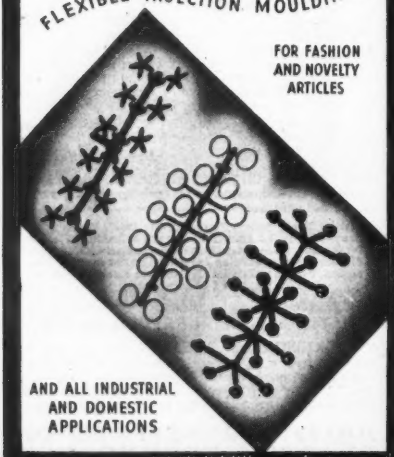
TOOLMAKERS TO THE ENGINEERING AND PLASTICS INDUSTRIES

The foundation of success in mouldings rests on first-quality Moulds. Our reputation ensures first-class returns to our clients. Repeat orders prove it! We design and manufacture compression-transfer-injection moulds of highest quality and finish. Jigs, fixtures, gauges, press tools, special-purpose machines, etc. Limited capacity also available for high-class batch production work.

Let US have YOUR enquiries for "that" job.

Pioneers!
in MOULDS for
MODERN PLASTICS
also Press Tools,
Jigs and Gauges.
BARBER & DUFFY LTD
214/222, Cardigan Road, LEEDS,
Telephone: LEEDS 52033
Member of the Gauge and Toolmakers' Association.

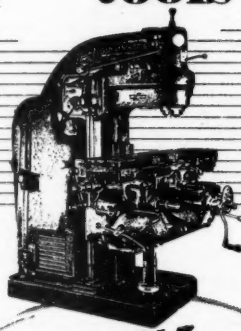
PLASTIC MOULDINGS
AND
CASEIN TURNINGS
To your particular requirements
FREDERICK W. EVANS, LTD.
PLASTIC WORKS, LONG ACRE,
BIRMINGHAM 7.
TELEPHONE:—EAST 1286 and 1287.

KENUTUF
FLEXIBLE INJECTION MOULDINGS
FOR FASHION AND NOVELTY ARTICLES

AND ALL INDUSTRIAL AND DOMESTIC APPLICATIONS
J. F. KENURE LTD. FELTHAM, MIDDLESEX Telephone: Feltham 2604-5-6

MOULDS *for the*
PLASTICS INDUSTRY
ALSO
JIGS, FIXTURES, PRESSURE
AND GRAVITY · CASTING DIES
J.H. CARPENTER & SON (LONDON) LTD.
316A YORK WAY, LONDON, N.7. Phone:-NORTH 1744

BYSON
FOR BAKELITE
Acetate and other Synthetic
Mouldings, Modern Plant
and Facilities
APPLIANCE Co LTD
WOOLFOLD, BURY, LANCS.
Telephone: Bury 1560-1 Telegrams: "Bysonite, Bury."

MORE THAN
1,500 DIFFERENT TYPES
machine tools



AVAILABLE NOW!

Government Surplus machine tools available NOW at attractive prices. YOUR opportunity to get better equipment and increase production.

DISPOSAL CENTRES, *where records of all machines available may be inspected, are open to the public for enquiries from 10 a.m. to 4 p.m. Monday to Friday inclusive :—*

BIRMINGHAM
C.M.L. Buildings, Great Charles Street.
BRISTOL
8/9 Elmdale Road, Bristol 8.
CARDIFF
Imperial Buildings, Mount Stuart Square.
GLASGOW
21 Glassford Street.
LEEDS
10 Bank Street, off Boar Lane.
LONDON
Room 0088, Ground Floor, Thames House North, Millbank, S.W.1.
MANCHESTER
Britannia House, Fountain Street.

ISSUED BY THE MINISTRY OF SUPPLY

"And ask if they have a strong Savings Group"

People changing to new jobs are finding that a flourishing Savings Group means a friendly atmosphere where it's easy to settle down. And it's a far-sighted management, as well, that knows the importance of group saving. During these difficult months of reconversion, a strong lead from managements, with the right people as Group secretaries, has been needed to keep Savings Groups really flourishing. *Your* backing is still absolutely vital. Saving is as important today as ever it was.

New groups
If you have no Staff Savings Group, will you get one started right away? Every place of employment should have its own Group.

Facilities
Experience shows that the fullest facilities induce the highest Savings. Ask your Local Savings Committee or Assistant Commissioner for details of the various schemes.

New members
If you have a Savings Group, will you do all you can to encourage the Staff to join ? — 'every employee a group member' should be the aim.

Savings clubs
These are the ideal way of saving for holidays, Christmas or other special occasions. Clubs are popular, easy to run and need not interfere with your Savings Group

Information, equipment and publicity material are provided free of charge — apply to your Local Savings Committee or to the National Savings Committee, Sanctuary Buildings, Westminster, S.W.1.

It's easier to save in a

STAFF SAVINGS GROUP

Issued by the National Savings Committee

CLASSIFIED ADVERTISEMENTS

Rate 4d. per word, minimum 4/-
— Box Number Fee, 1/- —
Instructions should be addressed to "Plastics," Bowling Green Lane, London, E.C.1

AGENCIES

Established firm of wholesale distributors, excellent connection southern counties, modern warehouse, wish to contact manufacturers of all types of plastics, either as agents or cash buyers. D. H. Ridout and Son, Ltd., 12 Stedman Road, Southbourne, Bournemouth. zzz-409

New Zealand representative, leaving July, willing to undertake market research. Agencies: Moulds, machinery, raw material, finished articles. Manufacture under licence. Write in confidence to Box 8505, care of "Plastics." 121-x4292

Export. London firm of exporters, with world-wide connections, solicits inquiries from manufacturers. Communications to Silvan Trading Co., Ltd., 7 and 8 Fores Lane, London, E.15. 121-x4166

Applications invited from agents by manufacturing distributors. All areas. Sole rights. Commission only. Connections and experience essential. Fullest particulars to Box 8515, care of "Plastics." 121-22

Agencies Wanted

Agencies wanted for the sale of plastic and Perspex articles. Offices operating from all large cities. Send particulars for cash on delivery to N. Gerver, Plastic Sales Dept., 2-10 Mare Street, Hackney, London, E.8. Phone, Amherst 5805 (five lines). 130-25

AUCTIONEERS' ANNOUNCEMENTS

RICHARDS AND PARTNERS,
AUCTIONEERS, VALUERS AND SURVEYORS
of
INDUSTRIAL PROPERTY, PLANT AND MACHINERY,
GRANVILLE HOUSE, ARUNDEL STREET, LONDON, W.C.2.
Phone, Temple Bar 7471 (four lines). zzz-408

BUSINESSES, PREMISES, OFFICES, ETC.

A factory to be sold as a running concern, including modern buildings, 4,000 square feet, all machines tools and raw materials, in the London area. Specializing in injection moulding, plastic fabricating and light sheet metal work. Price £14,750. Box 8483, care of "Plastics." 121-13

For sale, well-established Thermo business, London, turnover approximately £100,000 p.a. Price about £12,500. Box 8485, care of "Plastics." 121-15

MACHINERY, TOOLS AND PLANT

We can supply moulds and mouldings, injection and compression, with immediate delivery if you can supply moulding materials. Box 7687, care of "Plastics." 121-390

Rediffusion R.H.7 radio heater, practically unused. Box 8478, care of "Plastics." 121-8

Press tool for modern design bakelite extension speaker cabinet, size about 8 ins. by 8 ins. by 5 ins., sample cabinet will be sent to bona-fide inquirers upon request. Gardners Radio, Ltd., Somerford, Christchurch, Hants. 121-3

For sale, 1½-oz.-capacity Edgwick injection moulding machine, compressed-air operated, complete with motor-driven air compressor, 20 cubic ft. per min. at 800 lb. per sq. in. Motor h.p. 12½, and two storage bottles. Box 8531, care of "Plastics." 121-x4348

Two floor model Walker-Turner tilting 10 in. Arbor saws, complete with 230 volt A.C. motors, extension tables, guards and splitters, for sale in original packing-cases as received from works. Box 8484, care of "Plastics." 121-14

For sale, injection moulding machine for thermoplastic material, makers Braun A.G., Zerbst, Germany, type Isoma, capacity 25 grams per shot, electrical supply 400-440 v., 3-phase, 50 cycles; best offer over £550. Apply Box 8487, care of "Plastics." 121-17

Machinery, Tools and Plant Wanted

Wanted, several gramophone presses with tilting heads, pressure about 75-200 tons, in good condition, required immediately. Send full details to George Cohen Sons and Co., Ltd., Wood Lane, London, W.12. 121-5

PRODUCTION CAPACITY AVAILABLE AND WANTED

Pulverizing and grading of raw materials. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-369

Repetition in Ebonite, Erinoid, etc. Capstan lathe work. Mansell, Temple Street, Rugby. 125-8451

S. R. F. FREED, LTD.,
THE STOCKISTS OF SHEETS, RODS, TUBES, OFFCUTS AND SCRAP,
OFFER OTHER LINES WHICH CAN BE USED IN COMBINATION WITH PLASTICS,
UTILIZING ANIMAL AND VEGETABLE PRODUCTS,

Such as tortoiseshell, horn, cleaned and prepared cattle bones for industrial purposes, vegetable ivory nuts, porcupine quills, goose and duck feathers, and barrels, etc.

S. R. F. FREED, LTD.,
27b HIGH STREET, SOUTH NORWOOD, S.E.25.
Phones, Livingstone 4042; Sanderstead 2056. 121-402

Perspex Off-cuts, clear and coloured, cut to required size, lactoid rods and all forms of scrap plastic material; immediate delivery. Write, Plastic Department, J. E. Hoare, Byton Chambers, Amen Corner, S.W.17. zzz-399

Wanted, plastic waste and plastic piece goods. Send particulars, stating quantity and price. Box 6695, care of "Plastics." zzz-400

Perspex. We are stockists of I.C.I. Perspex. Try us for your requirements of clear and coloured sheets. Cuprex, Ltd., 1-3 Robert Street, Strand, W.C.2. Temple Bar 0902. zzz-405

Engraved name plates, scales, dials, etc., supplied. Tickets and Co., Box 2, Silver Street, Leicester. 129-9541

Urea moulding powder urgently required in pastel shades for export. Send fullest details to Box 7230, care of "Plastics." 121-9737

Rod—Casein or Cutelin rod required in ½ in. or ⅝ in. diameter. Substantial regular quantities needed, any colours considered. Write in first instance to Box 7302, care of "Plastics." 121-9734

Metal powders and oxides. Quotations and samples on application. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-410

W. Page and Sons,
34 Langside Crescent, Southgate, N.14. Phone, Palmers Green 5087.
The following lines always in stock:—
Wooden boxes, 18 by 12 by 9, at 2s. 8d. each; 21 by 12 by 9 at 2s. each. With lids.
12 by 12 by 12 Australian butter boxes at 1s. 4d. each.
Large tea chests at 5s. 9d. each. Small tea chests at 4s. 6d. each.
Export cases in ½-in. timber all round, 30 by 17 by 14, at 12s. 6d. each.
Cartons. Large, medium assorted cartons sold mixed in approximately the following sizes:—20 by 12 by 12, 19 by 13 by 15, 21 by 14 by 13, 23 by 13 by 10½, 13 by 10 by 21, etc., etc.
5,000 lots and over at 1s. 3d. each. Under 5,000 at 1s. 4d. each. 30,000 in stock.
Small mixed cartons. Sizes range from 17 by 12 by 6 to 8 by 5 by 5, approximately. To-day's cheapest carton at 6d. each.
Thousands of others in stock. We would welcome your inquiries, which shall receive our prompt and courteous attention.
All goods free delivered in the London area, f.o.r. elsewhere. zzz-421

Perspex for sale. New sheets, offcuts, large and small scrap; clear and colours in various thicknesses. Box 7676, care of "Plastics." 121-398

Wanted, plastic articles of every description for export and British Isles. Representatives active in all parts. Can place large orders for export. Write N. Gerver, Plastic Dept., 2-10 Mare Street, Hackney, London, E.8. 131-394

Wanted, plastic sheeting in all thicknesses from 1-16-in. to 1-in. Can place large orders for home and export markets. Please submit samples and prices to N. Gerver, 2-10 Mare Street, Hackney, London, E.8. 125-393

Production Capacity Available and Wanted (contd.)

Direct inquiries invited, home and export market, for moulded combs and Perspex fancy goods. Box 7691, care of "Plastics." 121-396

Work wanted, tool room available for all sorts of press tools. Press work, assembling, spraying and all sorts of engineering to your design. Universal Components, Ltd., 19 Sunderland Terrace, W.2. Bay 6776. 131-392

The Superb Stamping Co. Stamping in genuine gold "Krome" and colours for volume production. Acetates, Phenolics, wood, leather products where trade marks, wording and ornamentation required. 84 Highbury Park, London, N.5. Canonbury 1915. 122-x2323

Cellulose acetate scrap urgently required; best prices paid. Write, Cuprex, Ltd., Finsbury Pavement House, 120 Moorgate, London, E.C.2. Phone, Metro. 9641-5. zzz-424

We are able to undertake certain short or long runs of highly specialized medical and technical plastic moulded products. Injection, compression or sheet fabrication. Use our services for the preparation of prototypes. All inquiries strictly confidential. Box 7678, care of "Plastics." zzz-422

Inquiries invited for high-class printing on P.V.C. (limited quantities). Box 8527, care of "Plastics." 121-x4345

We have immediate capacity for design of all types plastic moulds and can assist in placing them for manufacture. Write or phone, The Lion Design Service Co., Ltd., 4 Castelnau, Barnes, S.W.13. Riverside 7771. 122-658

Mouldings. The I.D. Co. method of cast resin mouldings for small or large runs. Initial cost is much lower than for Bakelite mouldings. Have your product moulded by this new technique. Mouldings from 1 to 160 ozs. Inquiries to Industrial Development Corporation, 4 Whitchurch Road, Pangbourne, Berks. Phone, Pangbourne 39. 123-660

Injection Moulding Specialists have capacity up to 4 oz. available. Large quantities Polystyrene and Tenite powder in stock for export only. Contracts for home trade also invited. Box 8486, care of "Plastics." 121-16

Well-established firm would welcome orders, both home and abroad, for new model, lady's compact in coloured Perspex and brushed gold. Box 8141. 123-x3076

Capacity for mould making required. Firm with up-to-date plant capable of producing bakelite moulds to customer's detailed drawings at reasonable prices, and able to give prompt deliveries, communicate with Box 8232, care of "Plastics." 121-x3378

Toothbrushes (export). Manufacturer wanted 50,000 with customer's name. Glenaven Trading Co., Strathaven, Lanarkshire. 121-x4125

Grinding and kibbling. The Ripley (Derby) Grinding Co., Ltd., Heage Road, Ripley, Derby, would welcome inquiries from manufacturers and merchants for the grinding and kibbling of various materials for industrial and commercial purposes. 121-1

Grinding capacity available for cellulose acetate scrap only. Stewart Plastics, Ltd., 87 Gloucester Road, Croydon. Phone, Tho 3739. 121-6

We have increased capacity for the manufacture of plastic moulds, and can offer a high standard of workmanship and good delivery.
Blundell Bros. (Luton), Ltd., Engineering Division, Chaul End Lane, Luton, Beds. Luton 3976 and 4294. 123-657

Casein sheets wanted, all thicknesses. Box 8066, care of "Plastics." 121-27

Perspex wanted, ¼-in. and ⅜-in., dense opal. Box 8065, care of "Plastics." 121-26

Mould design, engraving and model making, capacity available. Expert attention. Box 8504, care of "Plastics." 121-x4276

Capacity available for finishing all types of plastic mouldings; trimming, drilling, polishing, assembly, etc. Box 8059, care of "Plastics." 122-401

Perspex. Large stocks, all thicknesses, available, particularly 1-16-in. and ¼-in., coloured. Write for price and stock list. Almex, Ltd., Exchange Buildings, Stephenson Place, Birmingham, 2. 122-399

SITUATIONS VACANT

Shorthand Typists, Private Secretaries, Clerks, etc. If you are in urgent need of staff, contact Embassy Secretarial Employment Bureau, Excel House, Whitcomb Street, W.C.2. Whitehall 5924. We specialize in efficient personnel. 124-8069

Applications invited for position of works manager for plastic factory on Tyneside, to engage in production of vinyl sheeting and coating, calendering, embossing, etc.; similar experience essential; also a background for developing new works. Applicants must submit full particulars of past experience, age and qualifications, all of which will be treated in strict confidence. to Box 8060, care of "Plastics." 121-400

Situations Vacant (contd.)

Expert, conversant with all methods of plastic transparent packing, wanted by firm opening manufacturing department for same. Box 8480, care of "Plastics." 121-10

Firm in the Plastics Industry (Southern Counties) have the following vacancies in their Research Laboratory:—
Qualified Chemist for work on organic problems.
Qualified Physical Chemist.
Qualified Physicist for research in industrial applied physics.
Well-paid positions with good prospects for the right men. Applicants are invited to submit in strict confidence full personal particulars, including experience and salary expected. Box 8496, care of "Plastics." 122-661

Manufacturing distributors require representatives, all areas. Salary and commission after short commission only trial. Defined territories. Existing accounts where applicable. Sales experience essential. Car preferable. Fullest particulars to Box 8516, care of "Plastics." 121-23

Engineer-salesman required with knowledge of plastics. Good prospects for inventive mind. Gratifying financial benefit for the right man. Applications will be treated in strict confidence. Box 8524, care of "Plastics." 121-29

Manager's assistant for casein button factory, London, required. Must be first-class tool maker with long experience. Very good wages. Good prospects. Write at once to Box 8525, care of "Plastics." 121-30

SITUATIONS WANTED

Plastics Technologist, specializing injection moulding, 1½-oz.-12-oz. machines, knowledge of compression and transfer moulding. Experienced works manager, built two factories from floor to full production stage. Desires to change area, overseas or London preferred, but not essential. Fresh problems main attraction. Excellent references. Box 8304, care of "Plastics." 121-x3586

Industrial Art Designer of proved ability, enthusiastic, original and practical, seeks responsible appointment with manufacturing company, in or around London, wishing to extend their activities. Special experience plastic sheetings, knowledge of materials, production methods and sales. Write full details, Box 8279, care of "Plastics." 121-x3515

Salesman, plastics engineer, works manager desires outside employment again as representative of wholesaler or technical representative of plastics products or machinery manufacturer. Box 8305, care of "Plastics." 121-x3586

Technical and practical engineer, 17 years' experience plastics and skilled engineering, design, costing and processing, seeks a progressive position. England or abroad. Box 8503, care of "Plastics." 121-x4276

TIME RECORDERS

Factory time recorders. Service rental. Phone, Hop 2239. Time Recorder Supply and Maintenance Co., 157-159 Borough High Street, S.E.1. 125-8459

VALUATIONS

PROCEDURE IN RESPECT INCOME TAX CONCESSIONS—DEFERRED REPAIRS.
MARTIN WOOD, SON AND PARTNERS,
The Valuers, of 81 High Holborn, W.C.1.
Phone, Hol 4485.
SCHEDULES OF BUILDINGS—MANUFACTURING PROPERTY, PLANT REGISTERS, DETAILED INVENTORIES COVERING INSURANCE AND TAX CLAIMS. WE SPECIALIZE PRECISION MACHINERY. 122-391

WANTED

Scrap plastic material wanted, any quantity. Perspex, Lactoid, Catalin, Acetate, Bakelite, Presspahn. Write, Plastics Dept., J. E. Hoare, Byton Chambers, Amen Corner, Tooting, S.W.17. 124-404

Scrap. Why not let a well-established firm quote you for cellulose acetate, polystyrene, P.V.C. cuttings and other thermo-plastic off-cuts and scrap? Having best use for these materials, highest prices can be paid. Quotations on receipt of representative samples to M. H. Grist (Plastics), Ltd., 82-84 Brighton Road, Surbiton, Surrey. Phone, Elmbridge 4214. zzz-395

Wanted, urea, scarab, phenol powders; any quantities, large or small; top prices paid. Box 7421, care of "Plastics." 122-x557

Regular supplies of paper-covered Perspex, coloured or clear off-cuts, large or small; lots of new Perspex sheeting; acetate suitable for lampshades, and any other material suitable for occupational therapy work. Plastics-Hobbies and Modelcraft, 12a West Laith Gate, Doncaster. 121-397

Wanted (contd.)

Celluloid sheets or offcuts in 20-60/000 in. thick, in transparent or opaque, urgently required for manufacturing purposes. Box 6899, care of "Plastics." 122-9545

Regular Supplies of Polythene Powder or offcuts required, plain or segregated colours. Must be free from contamination. Samples and price to Box 8495, care of "Plastics." 122-662

Wanted, black and ivory moulding powders. Large and small lots considered. Samples and quotations to Box 8491, care of "Plastics." 121-21

Phenol Formaldehyde moulding material wanted in large or small lots. Good price paid. Box 8213, care of "Plastics." 121-x3244

Pink and White Acetate or Nitro sheeting. Thickness .020-.040. Full sheets or offcuts. Top prices paid for clean material. Apply, Studio Manufacturing Co., 169-171 Brearley Street, Birmingham. Phone, Aston 3550. 122-x4132

MISCELLANEOUS

Photography by Behr will show your product at its best. Ask for illustrated list. 44 Temple Fortune Lane, London, N.W.11. Speedwell 4298. 121-9072

Monomarks. Permanent London address. Letters redirected, 5s. p.a. Write, Monomarks, BCM/MONO76, W.C.1. 122-9353

Ebonite and bakelite always in stock. Phone, Archway 3654. A. E Goodeve, Ltd., 188a Seven Sisters Road, London, N.7. 121-9075

Extend Your Trade.
Use a Trade Mark. Consult
Trade Mark Protection Society.
12 Church Street, Liverpool. 130-9745

Plastics Designers. Components, moulds and tools planned, designed and drawn. Alex S. Godfrey, 64a Clapham High Street, S.W.4. 121-395

Blister Hangars, 91-ft. span by 45-ft. long, and other sizes. Steel or asbestos roofing, open or closed ends. Suitable for repair shops, factories, storage, etc. Details from J. Thorn and Sons, Ltd., Box 115, Brampton Road, Bexleyheath, Kent. Phone, Bexleyheath 305. zzz-423

Quantity P.V.C. sheet, .040-in., high gloss, for immediate disposal. Box 8475, care of "Plastics." 121-x4146

For sale constantly, cut-offs of ⅛ and 1/16-in. natural Holoplast, from 1s. per lb., according to size of pieces. Larks Spraying Process, Monument Hill, Weybridge. 121-24

Perspex powders for disposal, regular supplies clean ground perspex in various mesh sizes. Box 8522, care of "Plastics." 122-676

Huts. Nissen type, 36 ft. by 16 ft., and other sizes; also other industrial buildings suitable for workshops, canteens, site offices, clubs, etc. No licence required. Write, phone or call (open Saturday afternoons). J. Thorn and Sons, Ltd., Box 138, Brampton Road, Bexleyheath, Kent. Phone, Bexleyheath 305. zzz-430

Plastic boards, 1/16 in., specially treated, highest artistic finish, suitable for panelling, furniture, bath, splashbacks, etc.; plain colours or marble effect, and wood (oak, mahogany, walnut, etc.), sheets 8 by 4 or cut to requirements. Prompt deliveries. Larks Spraying Process, Monument Hill, Weybridge. 121-25

We offer stock lots of plastic P.V.C. strip in assorted colours and sizes for prompt delivery. Box 8521, care of "Plastics." 121-28

For sale, cellulose acetate sheets—clear, 3 mm., 2 ft. 6 ins. by 1 ft. 6 ins., 30 cwt.; 4 mm., 18 ins. by 18 ins., 5 cwt.; 5 mm., 18 ins. by 18 ins., 20 cwt. Box 8523, care of "Plastics." 122-675

Advertisers have for sale pastel shaded translucent Urea powder for export only, dutiable, but duty recovered on proof of export. Box 8488, care of "Plastics." 121-18

For sale, celluloid in sheets and rods, cellulose acetate in sheets, cellulose acetate and polystyrene injection moulding compounds, phenolic moulding powder. Box 8489, care of "Plastics." 121-19

Laminated plastic in 5/32 in., ½ in., 7/16 in., ¾ in., and 1/64 in. thickness, approximately 3 tons, for disposal in one lot. Write Box 8490, care of "Plastics." 121-20

For sale, 15 tons P.V.C. black compound (recovered); samples available. Write to Cuprex, Ltd., Finsbury Pavement House, 120 Moorgate, London, E.C.2. zzz-428

We are now able to supply an adhesive suitable for cementing the Perspex which we supply. Inquiries to Cuprex, Ltd., Finsbury Pavement House, 120 Moorgate, London, E.C.2. zzz-429

For sale, Opal Perspex, 1-16-in., ⅛-in., 3-16-in. and ¼-in. thick, in standard-size sheets. Write to Cuprex, Ltd., Finsbury Pavement House, 120 Moorgate, London, E.C.2. zzz-427

Miscellaneous (contd.)

D. H. RIDOUT AND SON, LTD., AND G. PARKER AND CO.,
Manufacturers and Stockists,
Office and Showrooms,
12 STEDMAN ROAD, SOUTHBOURNE, BOURNEMOUTH.
Telephone, Southbourne 505 (2 lines).
Warehouse and Stores,
SEABOURNE ROAD, SOUTHBOURNE,
offer
HARD PLASTIC SHEETING,
Brown and Cream finish,
1/16 in. to 1 in. thick,
FROM 1s. 6d. PER SQ. FT.,
DOOR FURNITURE AND LOCKS COMPLETE.
Also
STUFFING MATERIALS FOR UPHOLSTERY, BEDDING, ETC.,
PLASTIC AND OTHER FINISHED GOODS, DOMESTIC, ELECTRICAL AND TABLE WARE.
Available for immediate delivery.
Builders' Merchants, Manufacturers and bona fide Tradesmen are invited to call or write. 121-4

For sale, P.V.C. strippings from cables, red, blue, brown, yellow and black, large quantities available. Box 8493, care of "Plastics." zzz-425

Acetate sheets, black, matt, 3 mm. thick, at 5s. lb., and 0.06 ins. thick at 4s. 9d. lb. ex warehouse, Jamesons, Pershore Street, Birmingham, 5. 121-x3414

Perspex, clear 5 mm. 10½ ins. by 10½ ins., colours ⅛ in. 9 ins. by 9 ins. and larger multiples, paper protected. Jamesons, Pershore Street, Birmingham, 5. 121-x3414

For sale, P.V.C. sheeting, 36 ins. wide, .015 to .018 thick, in black and other colours, at 6s. 0½d. per pound; delivery ex stock. Plastic Materials, Ltd., 3 Red Place, London, W.1. 123-x3420

For sale, P.V.C. scrap. Offers invited. Box 8494, care of "Plastics." zzz-426

Tubes in ivory casein, suitable for candle lamps, etc. Exchange Electrical, 41 Cheetham Hill Road, Manchester, 4. 121-2

Go'derstat Photocopies for document reproduction and inexpensive illustration of your offers. Golderstat, 54 Golders Gardens, London, N.W.11. Spe 5643. 126-659

Perspex for sale. Various colours, sizes and thicknesses, including clear, blue, cream and green in stock. Box 8477, care of "Plastics." 121-7

Polythene scrap. Approximately four tons of Polythene cable strippings for disposal; various colours, packed separately, but approximately 75 per cent. black. Replies to Box 8479, care of "Plastics." 121-9

1¼ and 2 mm. cellulose acetate clear sheeting. Box 8481, care of "Plastics." 121-11

For sale, two tons virgin celluloid acetate moulding powder in various colours, for use in home market. Box 8482, care of "Plastics." 121-12

BUSINESS ANNOUNCEMENTS

"PLASTICS" is published in London, England, on the second Wednesday of each month, and is obtainable to order from newsagents and bookstalls, or by post from the publishers. Annual subscription rate:—26/-, including postage. Shorter periods pro rata. Subscriptions are prepayable.

Head Offices: Bowling Green Lane, London, E.C.1.

Printed in England and Published Monthly by the Proprietors, TEMPLE PRESS LTD., BOWLING GREEN LANE, LONDON, E.C.1

RUBBER
IMPROVEMENT LTD.
Manufacturers of
Plasticised
P·V·C
Compound
ON modern, scientific plant we produce Polyvinyl Chloride and allied plastic compounds for all general purposes, including calendering, moulding and extrusion. Any opaque or translucent colour shade can be supplied, from black to white (also gold and silver). Our dielectric and sheathing cable grades conform to standard specifications, and are supplied in the mandatory and other colours. Special grades of P.V.C. Compound are supplied to suit customers' needs. Our Research Department will gladly co-operate with Plastics Manufacturers.
Leonex
RUBBER IMPROVEMENT LTD.
LEONEX WORKS · HYTHE ROAD · WILLESDEN · LONDON · N·W·10
TELEPHONE: LADBROKE 0171/2/3/4 TELEGRAMS: RUBBERLAND, HARLES, LONDON

JUNE, 1947. Vol. XI. No. 121. **Plastics** TWO SHILLINGS

Painswick Churchyard Gateway

Only three miles from Stroud, the Churchyard at Painswick has its legend of the 100 Yews. The Gatehouse, shown here, [illegible] stout timbers from the old belfry. The spire [illegible] Church is seen in our miniature.

Erinoid LIMITED

MANUFACTURERS OF [illegible] PLASTIC MATERIALS

—in the Cotswold Country

ERINOID LTD., LIGHTPILL MILLS, STROUD, GLOUCESTERSHIRE

Telephone: Stroud 810 (5 *lines*)

London Offices: 208A *Regent Street, W.1. Telephone: Regent* 0418

Birmingham: 3 *Coleshill Street, Birmingham* 4. *Telephone: Birmingham Central* 1886